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Cyanidation of Silver Ores, Pachuca, Mexico

The Ore Is Completely Slimed, and at the Mills Now Building Air Agitation Is to Be Used and the Ore Only Roughly Concentrated

BY CLAUDE T. RICE

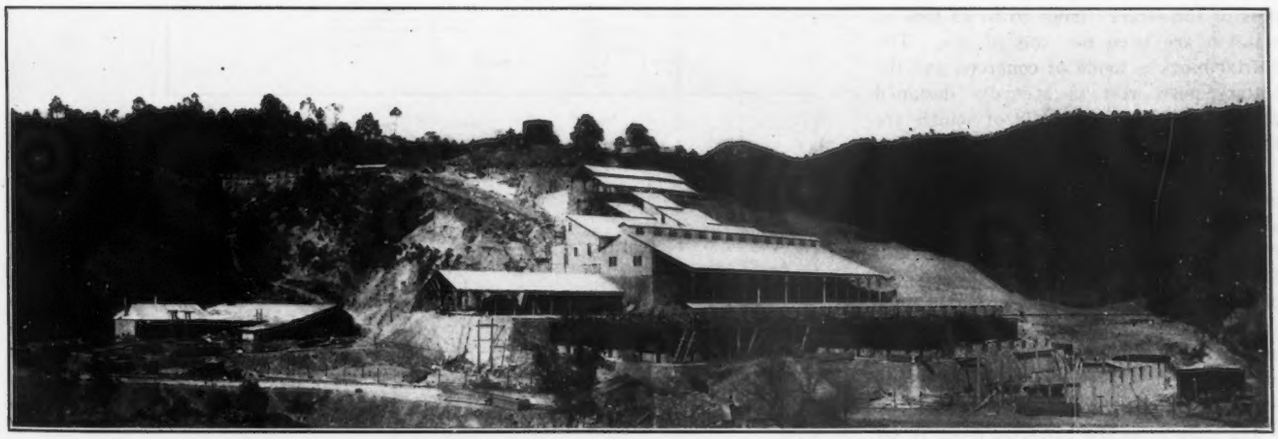
At Pachuca the first cyanide mills began to treat ore early in 1907. They were the Loreto mill, belonging to the Compañia Minera de Real del Monte y Pachuca, and the San Francisco No. 1 mill, belonging to the Compañia Beneficiadora de Metales. Since then the Guerrero mill, belonging to the Real del Monte y Pachuca company, and the Blaisdell Coscotitlan plant for cyaniding the old tailings have been built. The cyanide mill at the San Rafael is almost completed, and the cyanide addition to the La Union Hacienda is almost finished. So the period of cyanidation has reached Pachuca in earnest.

Pachuca has had the benefit of the earlier experience in the cyanidation of Mexican silver ores so that the cyanide only a rough concentration of the sulphide.

The Pachuca tank is the contribution of Pachuca to Western cyanidation. It was invented by F. C. Brown when manager of the Komata Reefs Gold mines, Ltd., in New Zealand, and first used in that country. A. Grothe introduced it at Pachuca, and has modified it somewhat; to him great credit is due for his boldness since it was the success attending its use at Pachuca which has brought the tank into prominence in America. At present the Brown or Pachuca tank is being installed at El Oro, Mexico, Goldfield, Nevada, and other places.

The ore at Pachuca carries only .5 grams of gold per kilogram of silver so that Pachuca is treating the nearest approach to a purely silver ore that is being cyanided. The ore milled in the district averages about 700 grams silver and 3.5 grams gold per metric ton. The gangue is silicious. The silver occurs as chloride or bromide in the oxidized ore and mainly as argentite in the unoxidized ore; few other sulphides of silver are found at Pachuca. Some of the ore carries a considerable amount of manganese and a little copper. The fact that much new construction is being done at the mills, even when silver is only 52c. per oz. speaks well not only for the Pachuca mines but also for the mills.

The Compañia Minera de Real del Monte y Pachuca has two mills, the Loreto at Pachuca and the Guerrero at Real del Monte. The Loreto mill has been transformed from a patio *hacienda*. On account of poor design the stamps have given so much trouble that the new management has had to re-erect the stamps; at the same time the crushing department is being remodeled along the lines of treatment used at the Guerrero mill. At the Guerrero mill the ore is crushed in stages until all the ore is reduced to a slime but before each recrushing the ore is concentrated so as to remove the sulphides as coarse as possible. The concentration is modeled after that at the Utah Copper Company's mill at Garfield, Utah. The intermediate grinding is done with Chilean mills crushing through a 40-mesh screen; the final sliming is done in tube mills.



THE GUERRERO MILL, REAL DEL MONTE Y PACHUCA COMPANY

plants exemplify the latest practice in the cyanidation of silver ores. What experience indicated at El Oro and Guanajuato has been taken as a starting point; consequently the mills have all been designed for complete sliming of the ores and for filtering of the pulp. At the cyanide mills of the Real del Monte y Pachuca company where the slime is treated by mechanical agitation ample provision is made for concentrating the sulphide in the ore, but at the San Francisco mill where air agitation is used little trouble has been experienced from foul solution, although the ore is only roughly concentrated. Therefore at the latest cyanide mills which are going to use the Pachuca tank for agitation provision is made for

On account of the unsettled condition at the Loreto mill where, during the remodeling of the batteries the ore coming from the breakers, has to be crushed in Chilean mills, the practice at the Guerrero mill will be described, and then details of the filtering at the Loreto will be given, since at the time of my visit the filtering plant at the Guerrero mill was not completed.

Practice at the Guerrero Mill

Before being sent to the Guerrero mill, all the ore is sorted so as to remove the waste and all ore assaying more than 2 kg. silver per ton. From the Cabrera and Escobar mines the ore is trammed by mules, but from the Santa Inez vein the

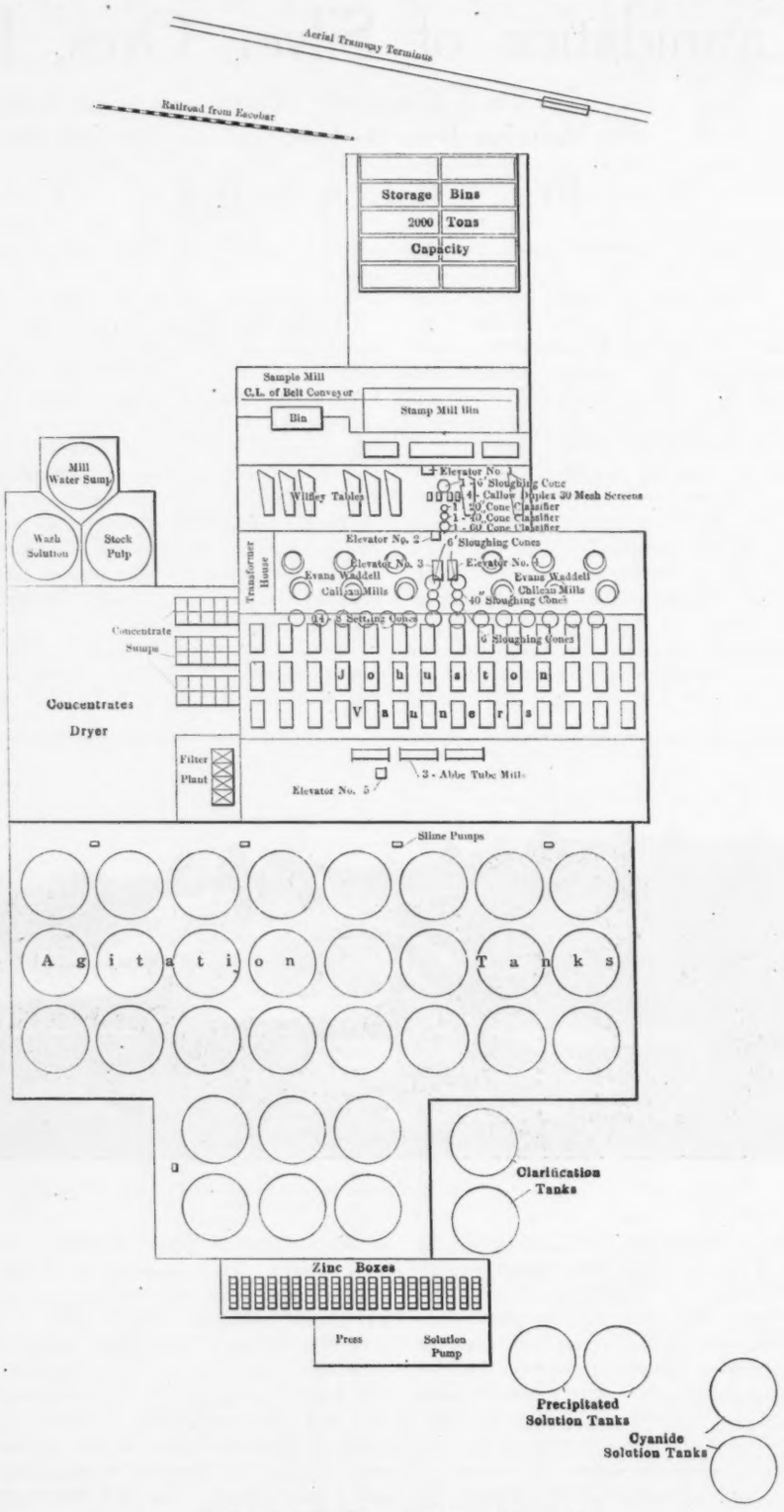
ore is brought by an aërial tramway. The ore is dumped into a 2000-ton wooden bin divided into 10 different compartments so as to keep the ore from the different mines separate for, owing to internal conditions under which the company is now operating, the mill must be operated almost as if it were a custom mill. The ore from the bin is trammed to the sampling department where after being crushed in a 10x15-in. breaker it goes to a Snyder sampler which removes 1/10; this 1/10 then goes to a set of 14x27-in. rolls, and, after being recrushed another 1/10 is taken out by the second Snyder sampler; this 1/10 after being recrushed by 12x20-in. rolls goes to the third Snyder sampler, which removes the final sample, a 1/10 of 1/10 of 1/10 of the ore crushed in the mill.

The rejects from each of the samplers falls upon the inclined Robins belt conveyer that takes the ore to a movable tripper over the battery bins; these have a capacity of 400 tons. These bins feed by suspended Challenge feeders to eight 5-stamp batteries arranged in units of 20, each 10 stamps being driven by its own belt from the unit line-shaft. These stamps weigh 1050 lb., and make 106 drops, 7 in. high per min. The ore is crushed in cyanide solution titrating 0.05 per cent. KCN; an 8-mesh No. 24 wire screen is used on the battery. At present owing to the coarseness of the screens from 10 to 12 tons of solution are used per ton of ore. The mortar-block is made of concrete, and the battery posts rest in specially designed cast-iron shoes, the details of which are shown in an accompanying drawing.

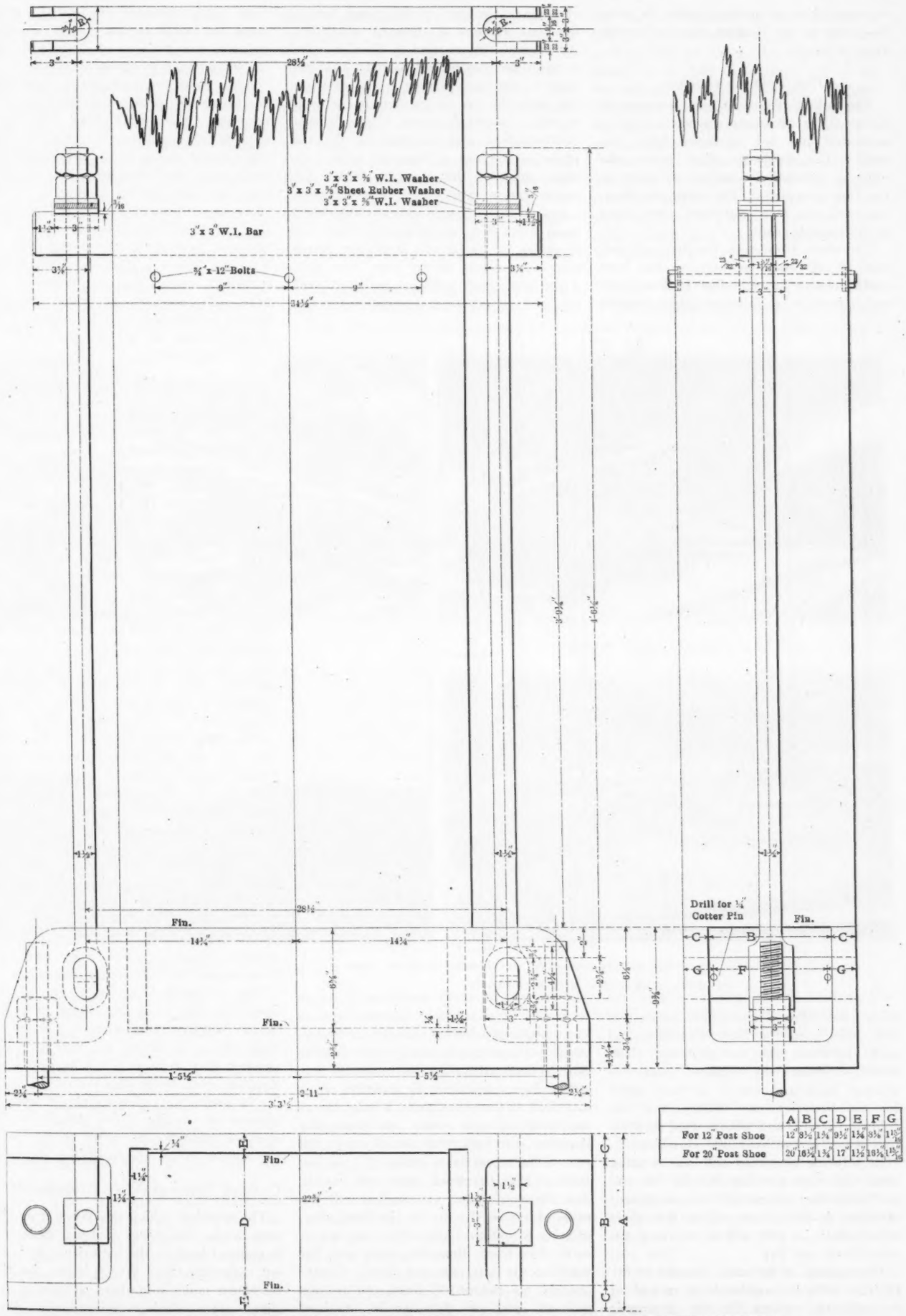
This battery-post shoe is made much heavier and stronger than the shoes usually furnished by stamp-mill manufacturers. The shoe has been designed so that the holding-down bolts can be easily replaced. These holding-down bolts are smaller than the anchor bolts, and are so proportioned that they should be the first part to break. This construction avoids the breaking of parts hard to replace.

The pulp from the batteries flows to an 8x16-in. bucket elevator which raises it to the 6-ft. sloughing-off cone; the overflow from that cone goes to the Callow cones above the slime vanners, while the underflow goes to two duplex Callow screens, on which a 40-mesh cloth made from No. 36 steel wire is used. At present in the cyanide solution these screens last only two weeks, but as yet the management has not had time to experiment with different sizes of wire in order to try to lengthen the life of these screens. The oversize from the Callow screens goes to six 6-ft. Evans-Waddell Chilean mills crushing through 0.018-in. diagonally punched rolled-steel screens; the undersize goes to two hydraulic classifiers, the diameter of one being 30 in., that of the other 40 in. The underflow from the first classifier goes to four Wilfley tables, while the overflow goes to the larger cone. The slime overflow from the second classifier goes to the Callow cones above the slime vanners; the underflow goes to three Wilfley tables. The tailings from both sets of Wilfley tables then flow to the Chilean mills.

The Chilean mills run at 35 r.p.m., and the plows are set so as to give as big a splash against the screens as possible. The reground pulp from the Chilean mills is raised by a bucket elevator to two sets of hydraulic classifiers, each set consisting of one 40-in. and one 60-in. cone. The underflow from the first cones goes to five Wilfley tables, and after being concentrated, returns to the Chilean mills; the overflow from the first goes to the second cone. The underflow from the second cone goes to 12 Johnston tables



PLAN OF GUERRERO MILL, REAL DEL MONTE



	A	B	C	D	E	F	G
For 12" Post Shoe	12"	8½"	1¾"	9½"	1¼"	8⅜"	1⅝"
For 20" Post Shoe	20"	16½"	1¾"	17"	1½"	16⅛"	1⅝"

DETAILS OF CAST-IRON BATTERY-POST SHOE-PLATE; REAL DEL MONTE Y PACHUCA COMPANY

treating this sand product, while the overflow goes to the Callow cones above the slime vanners.

The Dorr Classifiers

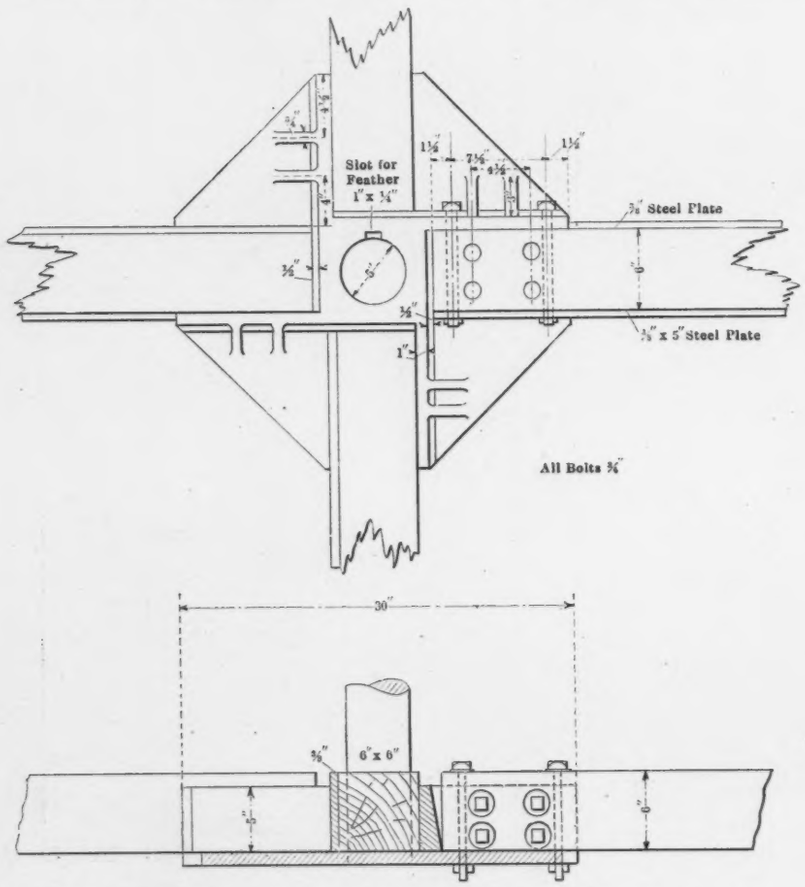
The tailings from the sand vanners go to two Dorr classifiers where the sand is separated and fed to three Abbé tube mills. The discharge from these tube mills is returned by bucket elevators to the Dorr classifiers. The slime overflowing from the Dorr classifiers goes direct to the cyanide plant.

The slime from both the first and second set of cone classifiers, as has been said, flows to 14 eight-foot Callow cones which feed the 30 Johnston tables treating slime; the tailings from these tables join the slime from the Dorr classifiers and go to the slime tanks for treatment. The overflow from the Callow cones is pumped back and serves as feed water for the batteries, the Wilfley and the Johnston tables, and also is used as pressure water in the hydraulic classifiers.

In July the Guerrero mill was treating about 250 tons per day, but by the end of September, when all the machinery indicated in the accompanying flow-sheet is installed, the mill will be crushing 300 tons of ore per day.

The amount of the sand returned to the Chilean mills is regulated by means of the upward current in the hydraulic classifiers; the size of the sand sent to the sand vanners is similarly controlled. At present this current is fixed to send to the slime vanners all particles that will pass a 100-mesh screen. Therefore at this mill the ore is crushed fine enough to pass a 100-mesh screen, before the final concentration, and so most of the sulphide in the ore is removed before the slime goes to the cyanide plant. The concentration ratio varies between 100 to 1 and 30 to 1. These concentrates, which assay from 8 to 40 kilograms silver and from 40 to 200 grams gold per metric ton, carry about 10 per cent. zinc, 1 to 4 per cent. lead, 0.8 to 1 per cent. copper, and 20 per cent. insoluble; the rest is mainly iron sulphide together with a very small amount of arsenic and antimony. About 45 per cent. of the extraction is obtained by concentration.

The Dorr classifiers do excellent work and feed to the tube mills a pulp carrying only 45 per cent. moisture; the launders that lead from the Dorrs to the tube mills are given a grade of 3 in. per foot so that the thick pulp will readily flow through them. As at this mill the main object of the use of the Dorr classifier is to obtain a thick feed not necessarily free from slime, the water jets for washing the sand are not used. Consequently an output of from 150 to 200 tons of sand per day can be obtained from each separator if desired. When using the water jet the output is greatly reduced, but 75 tons of slime-free sand can be obtained in 24 hours.



DETAILS OF CAST-IRON STAR FOR AGITATOR HAVING REINFORCED WOODEN ARMS; PACHUCA Y REAL DEL MONTE COMPANY

Silex liners are used in the Abbé mills, not because of preference, but because of necessity; with these Abbé mills, 4½x 16½ ft. in size, great trouble has been experienced owing to the breaking of the heads near the trunnions. This the company has remedied by casting, at its machine-shop, heavier heads. The spiral feed is highly recommended by V. B. Sherrod, consulting metallurgist to the Real del Monte y Pachuca company, but it would appear that the heads of this tube mill need to be made stronger. Danish pebbles are used for grinders, and about 800 kg. of pebbles per week are fed to each tube mill.

Cyanide Plant of the Guerrero Mill

The treatment tanks have flat bottoms. There are 24 of these, 10x30 ft. deep; mechanical agitation is used. Two of these tanks at present are used as collecting tanks, but the slime can be charged directly into any one of them as they are all equipped with central charging boxes extending down 18 in. into the tank. These consist of an outer solid box and perforated inner feed box, being similar to the charging boxes used by the El Oro Mining and Railway Company except that the outer box is not given the inward slant used at El Oro to concentrate the feed current. The slime pulp is agitated both by mechanical agitators (making 6 r.p.m.) and by 6-in. John A. Traylor & Co. centrifugal pumps, one pump being installed for each six tanks. But, as the main advantage of these pumps appears to be to aërate the solution, in the future three small air-jets will be placed in the bottom to affect the aëration; then the pumps will be used only to pump and transfer the slime, for the shafts wear out rapidly. That the main effect of the pump agitation is aëration has been proved by the fact that for several days after the use of the pumps is discontinued the extraction will remain as high as before; then as the air is exhausted the extraction decreases.

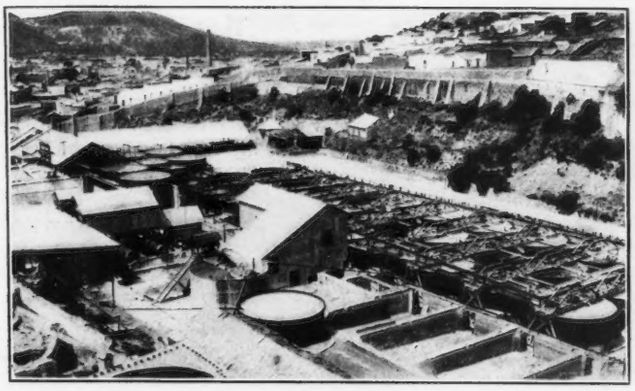
The mechanical agitators are of the four-arm type, each arm being of a different length; these arms rotate at a hight of 14 in. above the bottom. The agitator shaft rests in a ball-bearing footstep, the slime being kept out of the bearing by means of a cleverly placed upward current of solution. The details of the star for fastening the arms to the shaft are shown in an accompanying drawing.

Cyanide Treatment at Guerrero Mill

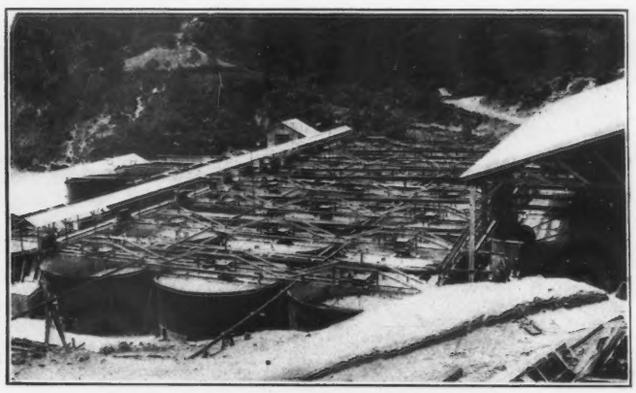
The solution, which overflows from the tank while the charge is being collected, is pumped back to the batteries. At present collecting takes 5 to 6 hours, for the treatment tanks hold about 50 tons of dry slime since during agitation a dilu-

tion of 3½ to 1 is used. When the charge has been collected, sodium cyanide is added sufficient to bring the solution up to the equivalent of 0.2 per cent. KCN.

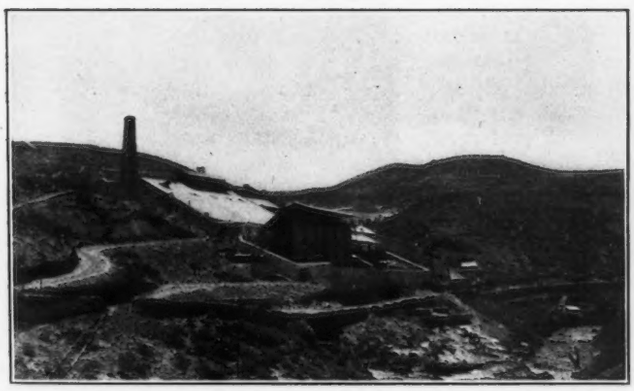
The first agitation lasts 36 hours; then the charge is settled for 4 hours. Decantation requires only 1 to 2 hours, for the slime at Pachuca settles quickly, taking about one-half the time necessary to settle the slime at Guanajuato. This possibly is due to the fact that at Guanajuato much of the ore is at least partially oxidized so that a more flocculent slime would be expected than at Pachuca where most of the ore milled is sulphide ore. After decantation, the pulp is agitated with unprecipitated solution titrating 0.15 per cent.KCN; ⅓ kg. of



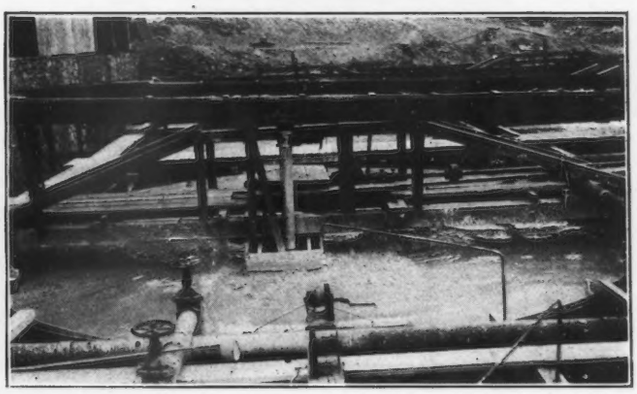
THE LORETO MILL



CYANIDE PLANT, GUERRERO MILL



SAN FRANCISCO NO. 1 MILL



CHARGE IN AGITATION; GUERRERO MILL

lead acetate per ton of dry slime is added during the first agitation. The second agitation lasts 8 hours. Then, after settling and decanting for 6 hours, the charge is given three agitations of 4 hours each with barren solution titrating 0.15 per cent. KCN; a period of 6 hours for settling and decantation, of course, intervenes between each agitation. Then the tank is filled with water, and the charge is given a final agitation of 4 hours. After the water wash the slime is allowed to settle for 24 hours, then the water is decanted. Finally the settled pulp, which contains 50 per cent. moisture, is stirred up with the agitators and discharged to the creek.

The solution from the first three agitations is precipitated, but the last two barren-solution washes are not precipitated, being used as the first two washes in agitating the next slime charge; the water wash is pumped to the mill solution. The decanted solution flows to an intermediate clarifying tank. The slime that settles in this tank is returned for treatment; the overflowing solution goes to six clarifying tanks, and from these it is decanted to the zinc-boxes for precipitation. At present about 1200 tons of solution are precipitated per day, for each day 1/10 of the mill solution goes to the precipitation boxes.

The precipitation room contains 16 zinc-boxes, each having 5 compartments, 3x4x2 ft. deep; these have a flat, trough bottom having a maximum depth of 6 in. at the center below the screen and of only 1 in. at each side. Fourteen of these boxes are used for precipitating standard solution, and two for mill solution. In cleaning up, an 18x18-in. Shriver filter-press making 24 cakes, 2 in. thick, is used to filter all precipitate that passes a 40-mesh screen. The precipitate is partially dried by compressed air in the press, and then is sent to the Loreto mill for melting. The short zinc is returned in a little tray to the first compartments of the stronger-solution zinc-boxes for no zinc shaving is used in the first compartments.

The cyanide consumption is 1.2 kg. sodium cyanide per ton of ore treated; the consumption of zinc is 1.4 kg. per ton, and the consumption of lead acetate is 0.33 kg. per ton; about 2.5 kg. of lime are used per ton of ore treated, 1.5 kg. being added at the tube mills and 1 kg. at the first agitation to aid in settling. The extraction is estimated at 85 to 90 per cent., but as yet the extraction at this mill is not accurately known.

The Butters filter at the Guerrero mill will soon be running; then the cyanide treatment will be similar to that at present used at the Loreto mill. The slime treatment, which now lasts 5 days will then be shortened to 72 hours.

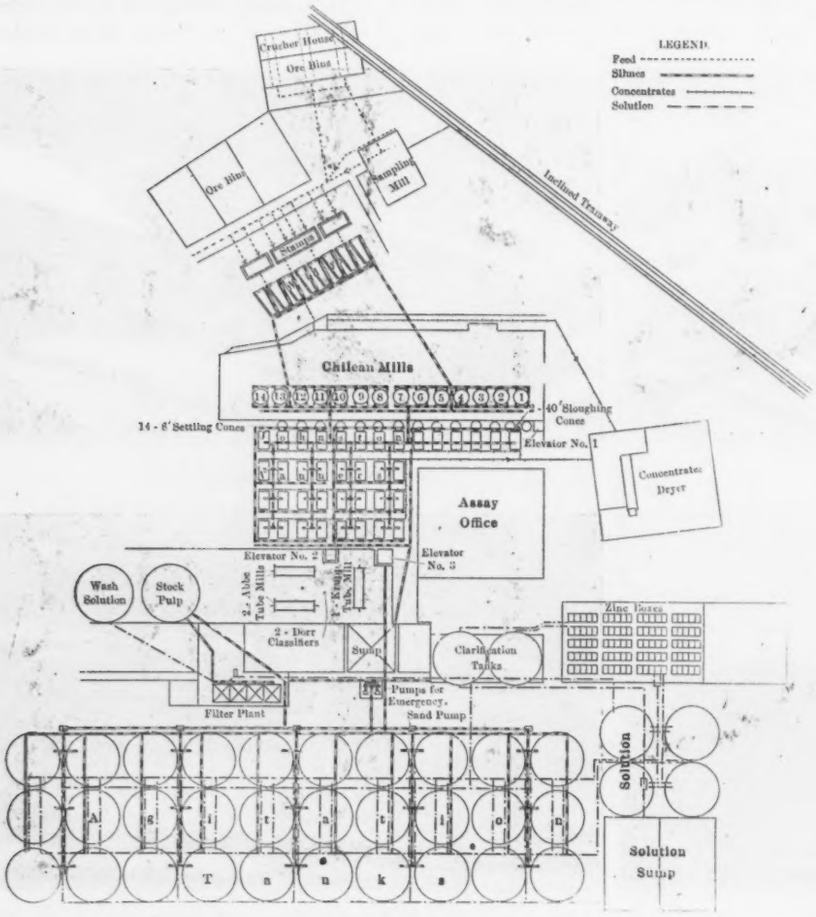
Cyanide Treatment at the Loreto Mill

The crushing equipment at the Loreto mill consists of five 7x9-in. Blake breakers, 40 stamps weighing 1050 lb. each, 14 old-fashioned Chilean mills, probably to be replaced by Evans-Waddell mills, and three tube mills, two Abbé and one Krupp. The concentration is done on 38 Johnston tables.

The ore is crushed in cyanide solution titrating 0.05 per cent. KCN, and is concentrated on the Johnston tables before going to the tube mills to be completely slimed. Dorr classifiers are used for separating from the slime the sand that goes to the tube mills; these work as satisfactorily at the Loreto mill as at the Guerrero mill.

The slime is collected in agitation tanks similar to those at the Guerrero mill; at present it takes 8 hours to collect a

charge. The excess solution is decanted off; then the tank is filled with standard solution titrating 0.15 per cent. KCN; during the first agitation 1/3 kg. of lead acetate per ton of dry slime and sufficient sodium cyanide to bring the strength of the solution up to 0.2 per cent. KCN are added. The first agitation lasts 36 hours; settling and decanting takes about 6 hours more. The second agitation with solution titrating 0.15 per cent. KCN lasts 6 hours; after decantation a third agitation lasting 6 hours is given. The charge is then pumped to the Butters filter plant, the filter having 104 standard-size leaves.



PLAN OF LORETO MILL, PACHUCA

A cake forms quickly as there is much granular slime in the pulp; consequently the cake is easily and quickly washed. A cake 1 in. thick is formed, and is discharged either by air or water, generally by using both. The cycle lasts 2 hours, the cake being formed in 45 minutes. Mill solution titrating 0.05 KCN is used for washing, and finally clean water sufficient to displace the mill solution is sucked through the cake. The tailings from the Loreto mill at present assay 90 grams silver and 0.3 grams gold per ton.

The Loreto mill is equipped with an old refinery, but this will be remodeled as soon as the company decides whether to use the electrolytic or sulphuric-acid process for parting the gold and silver. At present the precipitate is dried and fluxed loose in No. 300 graphite crucibles. This is melted once, poured into bars, and shipped at present as a doré bar 950 fine. The company is experimenting with oil and coke-fired furnaces for melting. The oil costs more, but owing to its greater convenience, smaller dust loss, and other advantages it seems preferable to coke. A briquetting machine is being installed; in the future the partially dried precipitate and the flux will be briquetted.

The Loreto plant is treating at present only 120 tons of ore per day, but its full capacity is 300 tons. This ore comes both from the Barron and the Camelia mine, but owing to the high cost of transportation from the Barron, it is probable that the company will soon build a cyanide mill near the Barron mine to treat that ore. The Guerrero mill is treating 250 tons at present, but it will be treating 300 tons by October 1. Even then the milling capacity of the Real del Monte y Pachuca company will be too small for the mines now operating, and, as the company reopens other mines either the capacity of these mills will have to be increased considerably or more mills must be built.

San Francisco No. 1 Mill

The San Francisco No. 1 mill, situated near the Maravillas and the San Rafael mines, is treating exclusively custom ores, mainly from these two mines; the tonnage treated is about 500 tons per week. The mill was originally a pan-amalgamation mill similar to the No. 2 or Progreso mill belonging to the same company, but in 1906 A. Grothe, then general manager for the San Francisco company, began to remodel the mill so as to use the cyanide process. A tube mill was added to slime the ore, and Brown tanks for agitating the slime.

The ore is first broken in two 12x15-in. Dodge breakers to about 1-in. size, and then goes to a 350-ton bin above the stamp-batteries. This feeds by suspended Challenge feeders to 30 stamps, weighing 1050 lb., that make 104 drops, 6½ in. high, per min. The ore is crushed through a 20-mesh screen in solution titrating 0.25 per cent. KCN. As a thick pulp is made by the batteries owing to the fact that only two tons of water are used per ton of ore, the pulp from each five stamps flows directly to a Wilfley table, no dewatering being necessary. The tailings go to two Frenier sand pumps and are raised to the classifying cones. The overflowing slime from these cones goes to the Pachuca tanks while the underflow goes to the tube-mill thickening cone. From the thickening cone the underflow, containing about 50 per cent. moisture, goes to the tube mill; the overflow returns to the classifying cones.

The tube mill is a Krupp No. 8A, being 4 m. long by 1.3 m. diameter. It runs at 29 r.p.m. and has El Oro cast-steel liners. Quartz ore and Danish pebbles are used as grinders, for when pebbles are used a lining is formed which protects the liners better than when quartz alone is used. One ton of quartz and 125 kg. of pebbles are added twice a week to the mill so as to keep it approximately half full of grinders.

The pulp from the tube mill is returned to the tube-mill cone, and as the coarse sand is reground, 80 per cent. of the pulp going to the Pachuca tanks will pass a 200-mesh screen.

The overflow from the classifying cones flows to one of the five Pachuca tanks where it is collected until the tank contains a charge of from 60 to 70 tons of dry slime. The overflowing solution from the Pachuca tanks goes to four settling tanks in which it is clarified; then it flows to a fifth tank from which it is pumped back to the batteries. The slime that accumulates in the clarifying tanks is pumped back to the agitation tanks and re-treated.

The pulp is agitated at a dilution approaching as nearly as possible two parts solution to one part slime. At the beginning of the agitation 20 kg. of lead acetate and sodium cyanide sufficient to raise

the solution to a strength titrating 0.45 per cent. KCN are added. The slime is agitated 48 hours; then it is discharged to the tank feeding to the Butters filters, this taking 2 hours. Sometimes when time permits the tank, after agitation is finished, is allowed to settle 6 to 12 hours, and 4 or 5 ft. of solution is decanted off, but with most of the Pachuca ores, although generally they are quick settling, filtering is faster than decantation.

Five Brown or Pachuca tanks 44 ft. 8 in. high by 14 ft. 10 in. diameter are used. The tank has a cone bottom whose slope is 60 deg., consequently the cylindrical part of the tank is about 31 ft. high. In the center of the tank and extending from about 18 in. above the charging level to the same distance from the bottom, is the central air-lift tube having a

PACHUCA TANKS SAN FRANCISCO NO. 1 MILL

diameter about one-tenth that of the outer tank. Into the bottom of this inner tube is led the compressed-air pipe which is used to give an upward motion through this central tube. Connection is made at the bottom of the cone with the 4-in. Butters centrifugal pump used to transfer the pulp to the filter-feed tank. At the beginning of agitation a pressure of about 50 to 60 lb. per sq.in. is used. When a good agitation has been started the pressure is decreased to about 25 lb. per sq.in., for experiment has shown that with this hight of tank about 25 lb. per sq.in. is the most economic pressure. Between the air compressor and the agitation vats there are five large air receivers; these are installed so as to enable short shutdowns of the compressor without derangement to the agitation.

Power Required by Pachuca Tanks

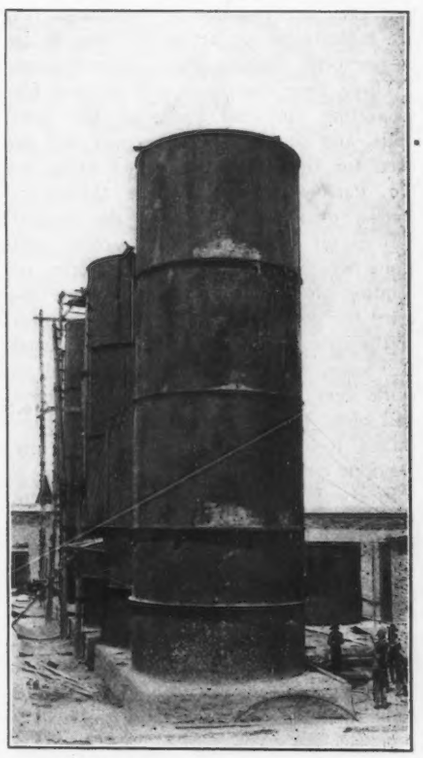
The amount of power required to agitate the tanks at this plant has not been accurately determined as yet, but from some tests it appears that the power consumed varies between 1 and 1.5 h.p. per tank according to whether one or three tanks are being agitated, the greater the number the less being the power required. F. C. Brown, of New Zealand, the inventor of the tank, states that when agitating eight tanks 40 ft. high by 10 ft. diam., each charged with 30 to 40 tons of sandy slime, the power required was from ¾ to 1 h.p., since from 10 to 13 cu.ft. of free air at 25 lb. per sq.in. were required per minute to agitate each tank. Finally he has decreased this to 12 cu.ft. of free air at 22 lb. per sq.in. pressure. In a tank 37 ft. high and 7 ft. 6 in. diameter only 4 to 6 cu.ft. of free air at 22 lb. per sq.in. pressure per min. (from ⅓ to ½ h.p.) were required to agitate a charge of 15 tons of dry slimes; when the same amount of finely ground concentrate was agitated in the same tank 15 to 20 cu. ft. of free air per min. at 26 lb. per sq.in. pressure (1½ to 2 h.p.) were required. As a result of these tests the Komata Reefs company is going to cyanide its concentrates. With ten tanks, 40 ft. high by 10 ft. diam., when all were in agitation, each being charged with 35 tons of dry concentrate, 88 cu.ft. of free air at 22 lb. per sq.in. (1.5 h.p. per tank) were required. With a 13x55-ft. tank, charged with 75 tons of dry slime, 32 cu.ft. of free air at 32 lb. per sq.in. (1¾ h.p.) were required.

In the Pachuca tank sufficient air, and to be run most efficiently only sufficient air, to keep the cone clear of slime should be used. Consequently with a heavier, quicker settling slime, like a slimed concentrate, more air is required than with a slow-settling slime. The amount of air required seems to vary with the square of the diameter rather than with the hight so that a narrow, tall tank is more economical than a shallow, wide tank. The degree of dilution should be about 2 to 1. The great advantage of the Pachuca tank is that it furnishes a positive agitation with a very low consumption of power.

The tanks at the San Francisco mill have worked so well that five are being installed at the La Union *hacienda* and ten at the San Rafael mill both at Pachuca. At the new Esperanza mill at El Oro, Mexico, to be erected to treat the mine ore and old sand tailings 12 Pachuca tanks have been ordered, while at the new Goldfield Consolidated mill in Nevada ten Pachuca tanks are being erected. All of these tanks are of the standard size, approximately 15x45 ft. high. Throughout Mexico one sees many small Pachuca tanks used experimentally both on slimes and on concentrates. These tanks seem especially adapted to agitating quick-settling ores like fine-ground concentrates, for with these tanks by increasing the pressure of the agitating air almost anything can be kept in agitation.

The slime from the Pachuca tanks at the San Francisco mill is filtered in two Butters filters, Moore, Blaisdell and Butters leaves have been tried on these filters, but all seemed to work equally well. It takes about 18 to 20 hours to filter a charge of about 70 tons, it being necessary to form eight cakes. A cake 1¼ to 1½ in. thick is formed in about an hour; then a weak-solution wash is given for 30 min. and a water wash for 10 min.; all the filtrate is sent to the four sand-filter tanks that feed the zinc-boxes.

There are ten zinc-boxes, each having five compartments 3x3x2½ ft. deep; the bottoms of these boxes slope only to one side. In cleaning up, the precipitate is worked through a 60-mesh screen and



PACHUCA TANKS AT LA UNION HACIENDA

the short zinc returned to the boxes. The precipitate goes to the filter-press; the cake is partially dried by air in the press. But before being fluxed the precipitate is thoroughly dried in pans. The bullion obtained assays 950 fine.

The mill is treating ores containing much manganese, and a little copper, lead, zinc and iron. These increase the difficulty of obtaining good extraction. A saving of about 90 per cent. is made when agitating 60 tons at a charge and 85 per cent. when agitating 70 tons at a charge. The ore treated assays from 700 to 1000 grams silver and 3.5 to 5 grams gold per metric ton.

The power required to run the crushing and milling plant is furnished by a 200-h.p.

motor, while a 75-h.p. motor runs the whole cyanide plant.

THE SAN RAFAEL MILL

At the San Rafael the new 250-ton mill, now being erected, is to use Pachuca tanks for agitation. This mill will have 60 stamps, 20 weighing 1250 and 40 weighing 900 lb., which will crush through a 20-mesh screen. The sand will be reground in three Krupp mills 20 ft. long by 4 ft. diameter, and the slime will be treated in 10 Pachuca tanks, 15x45 ft. high, it being the intention to use a 48-hr. agitation and to treat a charge of from 70 to 80 tons. A Burt clarifier will be used for clarifying the overflowing solutions from the tanks while two Moore filters, having 100 leaves each, will be used to filter the slime. At present only Wilfley tables will be installed, but space is being left for Johnston tables in case that they are required. Tests upon the ore indicate an extraction of from 85 to 90 per cent. without close concentration.

Three Dorr classifiers will be used for separating the sand going to the tube mills, and three Dorr thickeners will be used for thickening the slimes going to the Pachuca tanks. These thickeners consist of a tank having a flat conical bottom on which the slime settles and along which it is scraped by a series of rotating plows that convey the slime toward the central discharge at the bottom of the cone. This slime thickener is used at Pluma, South Dakota, and is said to work very satisfactorily. At La Union mill also, Pachuca tanks are being installed to cyanide the ore without any previous concentration.

In conclusion I wish to thank George A. Camphius, superintendent of San Francisco No. 1 mill, V. B. Sherrod and A. Grothe for kindness shown me while I was preparing this article.

Gold Dredging in French Guiana

SPECIAL CORRESPONDENCE

During 1907, French Guiana exported 4160 kg. of gold. Although a considerable part of this output comes from the ordinary sluices, a substantial part has been produced by dredging alluvial deposits.

At present the Placer Elysée, located in the region of the middle Mana, is worked by two dredges (Cie. Minière et de Dragages de Guyane). The first, made by Werf, Conrad, of Haarlem, Holland, is small and has an actual capacity of only 200 cu.m. per day; it served mainly to prove the possibility of dredging this placer ground on a large scale. The other dredge is larger and was built by Messrs. Lobnitz, of Glasgow. It was put into commission in December, 1907. Its main features are as follows: the ladder is fitted with 33 buckets, 3 cu.ft. each and is of the open-connected type. The buckets run at a speed of 15 per minute. The trommel or revolving screen is 7 m. long by 1.30 m. in diameter. There are 10 gold-saving tables fitted with cocoa matting and expanded metal. The actual capacity of this dredge is about 700 cu.m. per day, but owing the the shallowness of the marsh and the difficulty of properly clearing the way, the dredge is not able to handle this amount.

Gold dredging in Guiana seems to be more successful in working the beds of the rivers. In view of this two modern gold dredges are to be shipped soon to French Guiana to work on the deposits of the Sparwin river, a tributary of the Maroni (Sté. Anonyme du Sparwin) and of the Courcibo river, a tributary of the Sinnamary (Cie. Coloniale de Dragages Auriféres). They are of the open-link continuous bucket type, with 4.5-cu.ft. buckets designed to work at a depth of 9 m. The pontoon and gantries are entirely made of steel. A special feature of these dredges is a double revolving screen, 33 ft. long, intended to disintegrate thoroughly the clayey alluvials which are met with in Guiana. Besides the ordinary spray pipe leading from the centrifugal pump, two rows of monitors, fed by a Knowles pressure pump, will help to desintegrate the gravel. To prevent clay from sticking on the Turner gold-saving tables a special water jet has been arranged over the tables. This new device is the result of extensive experiments made on the Guiana alluvials by the inventor Mr. Potterau, who designed the dredges with Fraser & Chalmers, Ltd., of London and Paris.

Homestake Mining Company

This company, as is well known, owns a very large low-grade deposit of gold ore in the Black Hills district of South Dakota. Its operations are an example of the successful and profitable working of such ores. The present report covers the year ended May 31, 1908. For that period the total ore milled was 1,450,900 tons, the average return in bullion being equal to $3.251 per ton treated.

The accounts are stated in such a way that it is difficult to separate the costs. Analyzing them as far as possible, the results of the year's operations appear as follows:

	Amount.	Per Ton
Proceeds of bullion saved	$4,717,746	$3.251
Foundry and miscellaneous	91,759	0.064
Total receipts	$4,809,505	$3.315
Mining expenses	$2,378,944	$1.640
Milling expenses	861,943	0.594
Foundry and miscellaneous	115,590	0.081
Bullion freight	8,705	0.006
Taxes	74,729	0.051
General expenses, etc	164,823	0.113
Total expenses	$3,604,734	$2.485
Net earnings for the year	$1,204,771	$0.830

Mining expenses were 66, and milling, 23.9 per cent. of the total expenses for the year. The expenses were 74.9 per cent. of the earnings.

The income account in the same way works out as follows:

Net earnings, as above	$1,204,771
Balance from previous year	32,636
Bills payable	100,000
Total	$1,337,407
Interest and discount	$ 10,941
Slimes plant construction	86,548
Bills payable paid	250,000
Dividends paid	546,000
Total payments	$ 893,489
Balance at close of year	$ 443,918

The dividends paid were 2.5 per cent. on the stock. Dividends were suspended during the first part of the year on account of the fire in the mine, which stopped production for several months.

The report of Superintendent T. J. Grier says: "The Homestake adds another fiscal year to its life, and has long since fully recovered from the effects of its recent contact with fire and water. Development work resumed some months ago continues to give satisfactory results and to insure longevity to the mine. We reached the ore a short time ago in a westerly crosscut on the 1550 level at the Ellison shaft and are now crosscutting it. The west side of the same shaft at the 1700 level is likewise in the same vein, which will be crosscut as soon as the station is opened at that point. At the Golden Prospect shaft an additional 100 ft. in depth has been attained, making it 1000 ft. deep. At the Golden Star shaft we are raising from the 1250 level.

"The plant generally is in fine condition and is running smoothly in every department, with ore reserves in sight for a couple of decades."

Cyanide Practice in Mexico

SPECIAL CORRESPONDENCE

In a recent discussion by the Chemical, Metallurgical and Mining Society, of South Africa, on his paper on "Some Features of Silver-ore Treatment in Mexico," W. A. Caldecott described the chemical investigations upon which part of his paper was based, and closed with some interesting general remarks. Speaking as one of the leading Rand metallurgists, lately returned from a visit to America, he expressed the opinion that cyanide treatment in Mexico —though admitting the danger of generalizations in so wide and varied a territory—left wide scope for improvement on scientific lines.

He deplored the small amount of published data available, dealing with technical matters in that country. Incidentally, Mr. Caldecott suggested that the use of warm cyanide solutions, tried on the Rand with promise of successful application, might be advantageous in the treatment of Mexican silver ores; though the extensive use of electricity would be a circumstance liable to increase the cost of the scheme as opposed to the Rand with its available condensed steam.

Present Condition of Mining in Mexico

The Fall in the Prices of Metals Has Greatly Affected Prosperity but It Has Stimulated Increased Effort to Reduce Costs of Production

BY FRANKLIN WHEATON SMITH*

The mining industry in Mexico, no less than in other parts of the world, has felt keenly the effects of last year's financial cyclone. The general collapse of the metal market struck a harder blow to the general prosperity of the country than to that of the United States, for Mexico is still first of all a mining country.

Of the causes of the preëminence of mining, some are fundamental, others are due to present conditions. Two of the first are the very great mineral wealth of the country, and the comparatively large portion of its area unsuited to agriculture. Of the other causes, one is the concentration of the land in the hands of a few families. This, with the practical absence of land taxation that has made such concentration possible, does not tend to advance agricultural methods.

Mexico's agricultural possibilities are great, and it will be well for the republic when agriculture and not mining becomes the leading industry. The breaking up of the large land holdings by a system of land taxation and the development and education of the small independent farmer (a host that must be "humored, ah, slowly toward the light") would create a prosperous stratum in society where now there is abject poverty, and in proportion to its conservative prosperity would be impervious to a flood of panic. The present policy of the government seems to tend in this direction. What would be the mental attitude of business today if the United States were primarily a mining country?

Mexico a Mining Camp

Where all the land's a mining camp, each operating property brings local prosperity in proportion to the amount of labor it employs and the quantity of local produce that it consumes, and in the broader world each exercises a direct influence on the business of the distributing centers and the railroads. The Mexican Central has published the statement that 48 per cent. of its freight traffic is due directly or indirectly to the mining industry.

A rough estimate places Mexico's metal production for 1907 at $95,000,000. Of this silver represents about 45 per cent.; copper, 25 per cent.; gold, nearly 20 per cent.; lead, 8 per cent., and other metals, the remaining 2 per cent. In other words, commodity metals formed 80 per cent. of the product of the leading industry of the republic, and the market price of all of them recently underwent severe and simultaneous shrinkage.

In his message to Congress on April 1, 1908, President Diaz referred to the business depression, commented on "the contrast between the prosperity of the national treasury and the stringency which for some months past has prevailed in the business world," and said further:

"In my last message I alluded to the troubled condition of foreign financial centers which had produced a certain torpor in some lines of our industrial activity. At the same time there occurred a heavy decline in the prices of almost all our exportable products, owing largely to critical conditions in the markets where they are usually in demand, as well as other circumstances such as those that affect the price of silver, which is the most important of the articles in question. Naturally these disturbing factors have been felt with greater or less intensity in all lines of business, occasioning a stringency which, though attended with hardships, is also self-remedying, thanks to the natural conservatism which in general characterizes the commercial community of Mexico."

The Low Price of Silver

When this message was written the price of silver was 55⅜c. Its average for the first ten months of 1907 was 67.068c. per fine ounce; for the nine months from Nov. 1, 1907, to Aug. 1, 1908, it was 54.929c., and for the week ending Aug. 19, 51.33c. These figures carry their own commentary. One company reporting net earnings of $215,000, estimates that the drop in silver cost it $38,000 in reduced profits. Another, not yet earning profits, sees a badly needed income from high-grade shipments and concentrates, reduced by about $5000 a month.

Without doubt many of the smaller properties, owned by weak companies, have closed down; others are unable to ship ore that a year ago would have yielded a fair profit. But so far as known, none of the larger companies has found it necessary to suspend operations as did the Greene-Cananea, the greatest of Mexican copper producers, a year ago. That this suspension, disastrous as it was to local business and to stock values, was a wisely planned move, there can be no doubt. It enabled the management to make needed changes in system and equipment and to perfect plans for more economical operation, some of which were laid months before under a prior management. The results of the future will show how wise a move it was.

Foreign Capital

The mining industry of Mexico is practically wholly dependent on foreign capital for its power to expand. It was impossible that the world-wide depression should fail to make itself felt in the republic. Two years ago the mental attitude was, "How much can we make?"; recently it has been, "How can we avoid loss?": and when capital is in *that* frame of mind, it is in no mood to undertake new enterprises. Early in the summer, as conditions were beginning to recover, a new factor was introduced. A long and elaborate new mining law was drafted, containing some excellent provisions, but also four articles which at once produced most vehement discussion. They forbade foreigners owning mines in the border States and foreign corporations owning them in any part of the Republic. The alleged reason was that these provisions would prevent "trusts" from dominating the industry and also make wildcatting impossible.

Neither wildcatters nor "trusts" were heard in the ensuing discussion, but the legitimate mining industry expressed itself through the Chamber of Mines and through the columns of a leading paper, that usually is exceedingly circumspect in its comments on Mexican affairs. The discussion did not turn on any alleged injustice or oppression that the new law would cause, for no such objections could be urged against it. "Unnecessary" and "inexpedient" indicate the line of argument, and the points were well taken.

Mexico is not yet strong enough to undertake unaided its own development. Foreign capital, particularly American and English, looks favorably on it as a field for investment. It is a fact that much English capital prefers Mexico to the United States, partly for the very reason that would be abolished by the passage of this law. It has not yet passed, and probably it will not. The harm it has done so far has been due to more or less vague apprehension aroused in the minds of investors not perfectly informed about the situation. It is impossible to estimate the actual damage done by the fear of its passage. Undoubtedly it has scared off some investors, but it is probable that its effect so far has been overestimated. "Inexpedient" is the worst that can be said of it; if passed, it will injure mining in that it will tend to bar out capital of a certain

*Mining engineer, Bisbee, Arizona.

temperament, but if it is passed it will not constitute a valid reason for advising against investment in Mexican mines.

LOWER COST OF PRODUCTION

Every hard times has its influence, both constructive and destructive. On constructive lines, every advance in metallurgy means a lower cost of production; every company forced by low prices to realize that intensive methods have their place in mining no less than in agriculture and manufacture, adds a little to the stable foundation of prosperity. On the other side, many of the deserving, but weak, will suffer, but every wildcat down and done for means so much less yowling from the advertising chimney-tops of an unenlightened press, and for this boon our not-small thanks.

The advance in metallurgical practice, particularly in the cyanidation of silver enabling more mines to treat their product on the ground, has in very great measure increased the earning power of mines in good times and their endurance in bad. The low price of silver, while sorely felt by many individual properties, has not the prostrating effect on the industry in would have had if there had been no improvement in method during the past five years.

The government is stable and will continue so. Labor is cheap, and when under proper management, judging by cost of results (dollar for dollar, not man for man), is more efficient than American labor. Peon temperament and economic conditions make it improbable that powerful and coherent labor unions will ever be formed. It is a dangerous policy for a foreign company to place in charge of its work a man ignorant of the language, laws and customs of the country. Whether or not this leads to disaster depends on the man himself, and as much on temperament and personality as on ability. One not infrequently hears that readiness to scratch the itching palm is a prime requisite for doing business in Mexico. It is a woful mistake. Dishonest officials exist, of course, but with the great majority courtesy will gain its ends better than corruption, and frankness than fraud.

CONDITIONS IMPROVING

General conditions are improving, despite a depressed market. There is a reasonable profit for legitimate mining in Mexico today. It is fair to expect a gradual improvement in prices. That which has affected the price of products has affected the price of mines, and low prices mean better chances for moderate capital that wants prospects, or partially developed properties; that has faith in the markets of the future and is not scared by a bogy of today; not scared, but merely made conservative and so led to examine with greater care the properties offered. Careful selection means fewer failures; success in a district means more investment there, and thus the situation contains the seed of its own regeneration.

The Scotch Shale Oil Industry

The distillation of oil from shale in Scotland is one of the very few industries of the kind that have survived the competition of petroleum. Though their industry is comparatively a small one, the Scotch shale-oil companies have succeeded in holding their trade and in making sufficient profits to pay dividends on their stocks year after year. They have done this by close and careful working, reducing expenses to the lowest possible point, and saving all the by-products.

The custom in the trade is to sell illuminating oil on yearly contracts, usually made in August. This year the contract price is 12.5c. per gallon, a reduction of 0.5c. from last year. Lubricating oils are sold on the open market, in competition with imported oils, and the present price is $2.40 per ton below that realized a year ago. To offset these lower prices, however, coal is cheaper, and mining costs are lower than last year, the shale-miners' wages being regulated by the coal-mining scale. Moreover, there has been an increase in the price of sulphate of ammonia, the most important by-product.

Notwithstanding the lower prices of oil, the Scotch companies have the prospect of another good year. It is an interesting case of a small industry not only holding its own, but prospering, in the face of what is apparently an overwhelming competition.

Effect of Borax in Assaying

J. E. Clennell (*Journ. Chem. Met. and Min. Soc. of South Africa*, April, 1908) has contributed to the discussion of G. B. Hogenraad's paper in the Aug., 1907, number of the above journal, by submitting the results of some experiments. Mr. Hogenraad believed that the low results and poor slags obtained by him in assaying a silicious ore were due to the large amounts of borax used in the flux. On the other hand, the author believes that the use of borax was not the cause of the losses in gold and silver, but were due to insufficient litharge in the charge, or to an excess of charcoal, rendering the charge somewhat infusible, thus causing mechanical losses. As a result of a course of experiments the following points were observed:

(1) A large excess of borax gives a hard, stony slag, difficult to separate clean from the lead button. In hammering out the button the slag flies to pieces violently, carrying with it a portion of the lead, some part of which is sure to be lost unless extreme care is taken in collecting all the fragments. This may possibly be a cause of some of the observed losses of borax.

(2) When no borax at all was added, the button usually separated quite clean from the slag, which was amber-cooled, and while cooling, a scum of straw-colored crystals collected on the surface. The addition of borax rendered the charge distinctly more fusible; this seems to be contrary to Mr. Hogenraad's view, as he apparently ascribes the sticking of the lead to the mold to the extreme fluidity of the non-borax slag. The author is inclined to draw the opposite conclusion; the fact that the lead leaves the pot before the slag, would seem to show that the latter was not sufficiently fluid.

(3) The non-borax flux was considerably more deliquescent than the ordinary borax flux; this, however, causes no inconvenience, unless the fusions are left in the molds for several hours.

(4) The use of a small quantity of borax in the charge, that is, 5 to 10 grams per a.t. of ore, gives a uniform, fusible slag without a noticeable amount of the scum previously mentioned; the buttons may be detached from the slag by a slight blow, and do not adhere to the slag.

An average of 297 assays without the use of borax gave 18.169 dwt., while 297 assays using the same flux with the addition of borax gave 18.185 dwt. gold. The ore on which the tests were made was similar in character to the Rand banket, being practically free from iron pyrites, although carrying considerable quantities of iron as black oxide. The most satisfactory fluxes were as follows:

Flux: Parts by Weight.	Mine and Mill.	Cyanide Originals and Slimes.	Cyanide Residues.
Bicarbonate of soda	2500	2400	3600
Fused borax glass	200	200	400
Litharge	2500	2400	3600
Charcoal	60	50	60
Weight of Charge.			
Ore for assay	1 a. t.	2 a. t.	4 a. t.
Flux (grams)	120	200	300
Cover of soda (grams)	10	15	20
Lead button obtained (grams)	30	40	45

These charges were partly determined by the stock of fluxes and crucibles available and might be modified under other conditions.

Progress of the Dry-air Blast

In addition to the installations recently noted, licenses to use plant for drying the air for blast furnaces under the Gayley patents have just been taken out for nine furnaces, as follows: Toledo Furnace Company, Toledo, O., two stacks; Federal Furnace Company, Chicago, two stacks; Northwestern Iron Company, Mayville, Wis., two stacks; Youngstown Sheet and Tube Company, Youngstown, O., two stacks; Cleveland-Cliffs Iron Company, Marquette, Mich., one stack. The United States Steel Corporation has also ordered the installation of a drying plant for the bessemer steel converters at the South works of the Illinois Steel Company.

Nacozari Mining District, Sonora, Mexico

A Region Which Formerly Yielded Gold, Silver and Lead, and Now Promises to Become One of the Chief Copper Camps of the Republic

BY B. E. RUSSELL*

The town of Nacozari is situated at the southern terminus of the Nacozari railroad by which it is connected to the Arizona-Sonora line at Douglas and Agua Prieta, 77 miles distant. The railroad facilities are limited to this road at present, but the grade of the Cananea & Yaqui River or Randolph lines of the Southern Pacific has been opened for about 20 miles south of Nacozari toward the connection with the Guaymas line of the same system. The Nacozari railroad connects at Douglas with the El Paso & Southwestern, which runs from there to Benson, Ariz., and El Paso, Texas; while the Southern Pacific extension from Nacozari will give a seaport terminal on the Pacific ocean at Guaymas, about 200 miles distant.

Nacozari lies about 65 miles southeast of the camp of Cananea. The town lies on the creek of the same name which forms the headwaters of the Moctezuma river flowing into the Yaqui river and thence into the Gulf of California, and comprising the general route followed by the surveys of the Southern Pacific lines. At Nacozari are situated the works of the Moctezuma Copper Company, a public library, a hotel, a store, offices and private residences of that company. The original reduction works consisted of a concentrator which is still in operation, and a smelter that has been idle since the completion of the railroad about four years ago. Since that time the concentrates and first-class ores have been shipped to the Old Dominion and Copper Queen plants in Arizona. The material for the old works, together with the equipment for the five-mile narrow-gage road connecting them with the Pilares mine was shipped into the camp from Naco, Ariz., by freight teams before the completion of the Nacozari railroad.

About a year ago plans for a new concentrator were started, and the mill, a model of reinforced concrete and steel construction, has since been completed. The mill is built in two units of about 750 tons daily capacity each; it is equipped with 72 Johnson vanners, 56 Wilfley tables and 44 iron jigs, built according to special plans prepared by the engineer in charge of construction. The old concentrator has been treating ore at the rate of about 20,000 tons per month, producing about 11,000,000 lb. refined copper annually; this figure can be increased to 35,000,000 lb. by the aid of the new works.

Power for the mine, mill and lighting is generated in Nacozari where the Moctezuma Copper Company has two plants. The old plant is equipped with Crossley producer-gas engines, belt connected with alternating-current electric generators. The new plant is equipped with four 450-h.p. Sterling boilers and three 1000-kw. Curtis General Electric steam turbines direct connected with three-phase alternating-current electric generators, stepping down from 6000 volts at the plant to 230 at the motors. These plants are not connected up, one handling the power and

PILARES MINING CAMP, SHAFT OF PILARES MINE ON LEFT

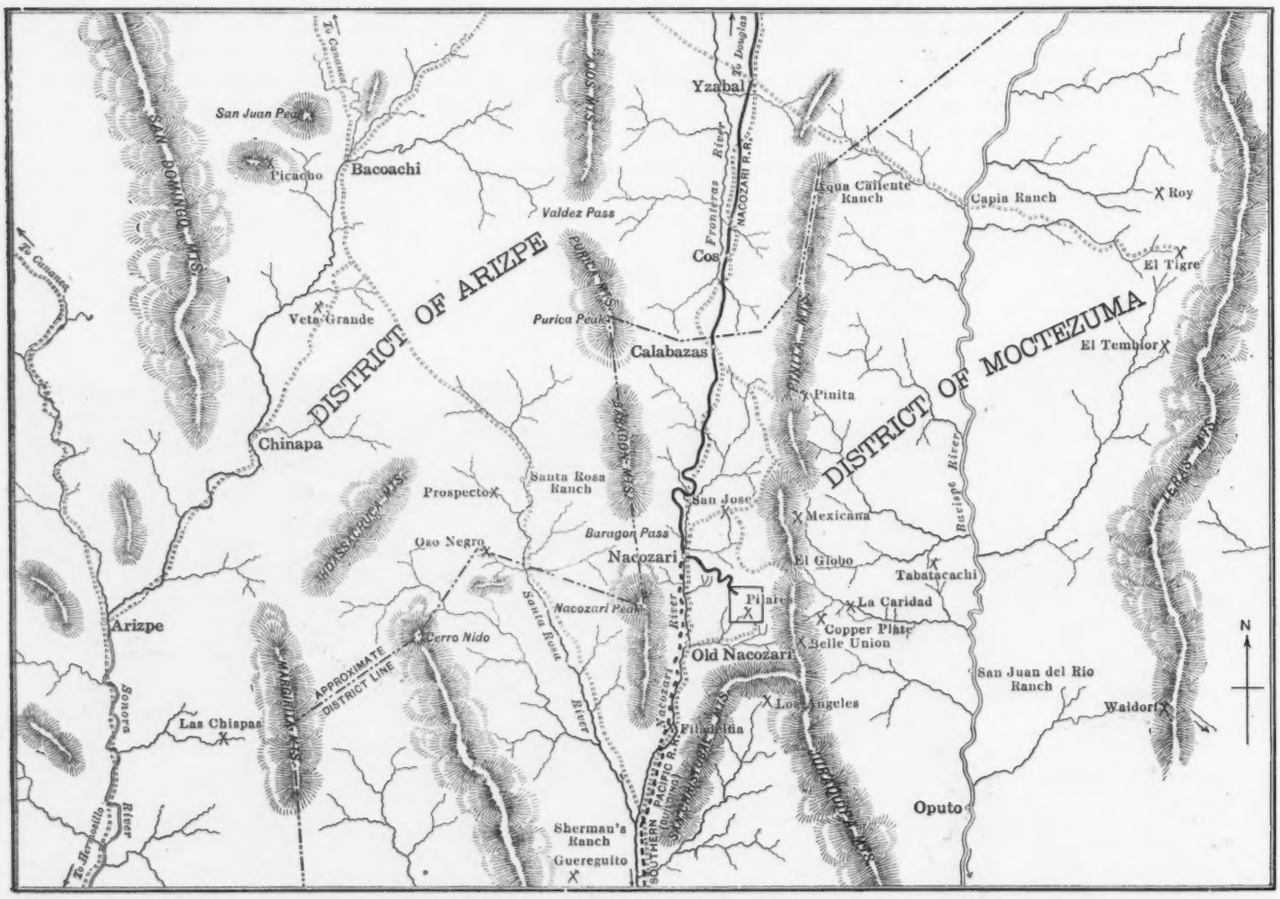
*Mining engineer, Nacozari, Sonora, Mex.

lighting for the town and the mine while the other provides power for the new concentrator.

The narrow-gage railroad connecting the concentrators with the Pilares mine is laid with 85-lb. steel, and ballasted with slag and gravel. The rolling stock consists of two 50-ton Baldwin locomotives and 25- and 30-ton Ingoldsby side-dump reinforced-steel cars.

Early Mining

The earliest known mining in this section was done by the Spanish priests, whose records refer to work being prosecuted as long ago as the year 1600. Since that time it continued in a desultory fashion until the advent of the Americans in recent years. Some of the early writings that have come down to us through church records speak of the fabulous richness of the mines, the most noted of which was the Huacal, in which the bullion was supposed to have been walled up when the Indians made it too warm for the clergy. Humboldt speaks of having come up the Nacozari cañon and of hearing of this mine, but he did not visit it. However much or little truth there was in their accounts, the fact remains that except where water drove out the ancients, the "modèrnos" have thus far been unable to work successfully properties abandoned long ago. The smelter dumps which I have sampled never yielded more than a few ounces in silver. The arrástra dumps, however, show a higher value; old tailings have been shipped to the smelters with good results. The process used in the arrástras was very much like pan-amalgamation. The ancients do not seem to have used the patio to any extent, if at all. In their adobe smelters they worked the baser ores of silver and lead, but what method they used in parting these two metals is uncertain. The copper ores that have brought the camp into prominence in later years were avoided by the *antiguos* except when very rich in silver.



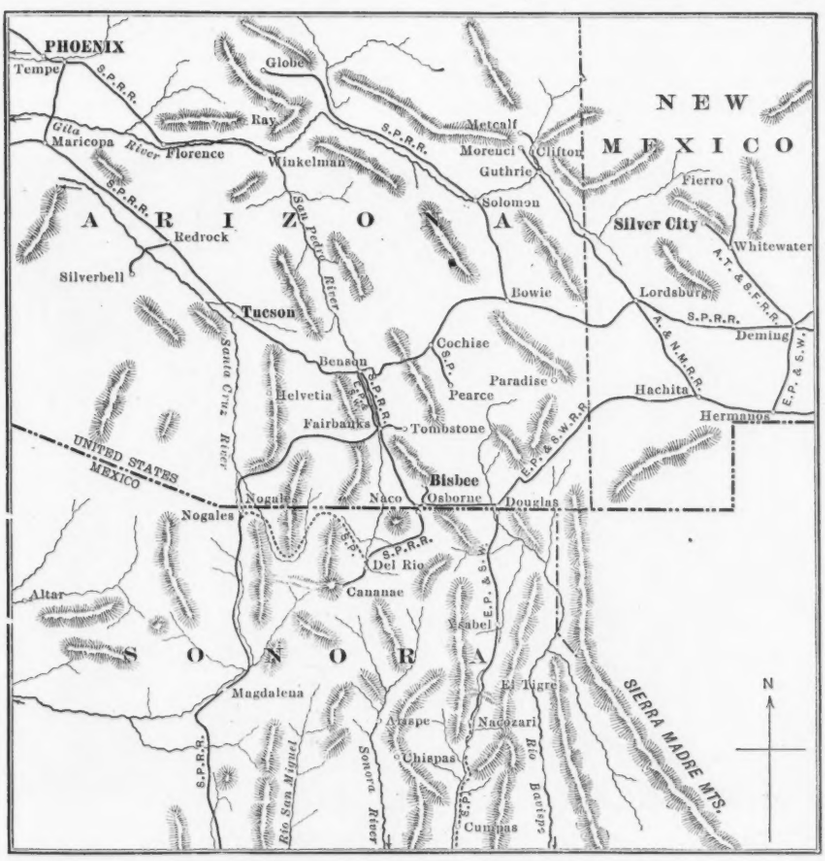
MAP OF THE MINERAL DISTRICTS AROUND NACOZARI, SONORA

The Ore Deposits

For convenience in classification, without any particular reference to geological conditions the district may be divided into four general belts or mineral-bearing zones. The first and most important is on the line of the Pilares uplift and covers a large territory extending from a short distance east of Nacozari in a general southeast direction for about 10 miles. The second starts at a point about four miles north of Nacozari, near the railroad, and continues for about eight miles to a connection with the first belt. The third follows the general trend of the Nacozari mountains, starting at a point about 10 miles northwest of the town at the foot of the Purica range and continuing south for 10 or 12 miles. The fourth is a more or less isolated belt lying about 15 miles west of Nacozari on which work is being resumed after 20 years of somnolence. In addition, the districts of Tabotacachi and Cumpas may be included, which, while not in the Nacozari district proper, are dependent on the camp for materials and shipping facilities.

The Pilares uplift, as it is called locally, derives its name from the Pilares mine of the Moctezuma Copper Company which has attained the greatest development of any property in the Nacozari district. This property is opened to a depth of about 700 ft. below the crest of the ridge in which the orebodies apex, or to the 600-ft. level below the collar of the main shaft, besides a surface tunnel and a second shaft from the surface that is now being sunk below the 600-ft. level, the level of the Porvenir tunnel. From the railroad yards at the mouth of the tunnel to the Pilares shaft, a distance of about 5000 ft., the railroad cars are handled by motors which bring them to the chutes, where they are loaded and then taken back to the mouth of the tunnel to be transferred to the concentrator by the narrow-gage road.

The Pilares orebodies are worked on the "filled stope" method, the only timber used being that needed for chute mouths and shaft sets. The stopes, some of which cover as much as 30,000 sq.ft., are opened for their full extent and then back-stoped. Enough ore is drawn from the stopes to keep the back at a convenient distance for working, and the balance is left to be drawn off when the orebodies above have been worked out. All the men except the mine foremen and timbermen are Mexicans and the work is done on the contract system, the holes being pointed by the foremen and measured up and paid for according to the amount drilled and the character of the ground. At intervals raises are run through the orebodies and down these the overflow of ore is shoveled to drop to the loading chutes at the tunnel level, or to be transferred to other chutes leading to this level, as the case may be. Under this system the probable cost of the ore per ton at the mouth of the tunnel is about 1.60 pesos.



MAP OF SOUTHERN ARIZONA AND NORTHEAST SONORA

Origin of the Ore

In an article in the JOURNAL of Dec. 8, 1906, Professor Emmons says in regard to the geological conditions at the Pilares mine: "The rock forming the groundmass of Paulina hill is a fine-grained andesite very much altered. It forms, in a great part, an eruptive breccia in which the matrix and inclosing fragments are of the same material, and it often shows a distinctly bedded structure. The ore is essentially a breccia of which pyrite, chalcopyrite and quartz constitute the original cementing material, for, although much of the more massive material is impregnated with metallic sulphides, this impregnation has thus far proved commercially negligible. The primary ore minerals are pyrite and chalcopyrite, the products of secondary enrichment being bornite and chalcocite. The whole mass of Pilares mountain between the two shafts (a distance of about 2200 ft.) is more or less impregnated with ore, although not always of a grade that will pay to work under existing circumstances."

Professor Emmons accredits the formation of the ore or its zone of greatest enrichment to the presence of two fault planes, one running north and south and the other running east and west, the two intersecting about 30 ft. east of the shaft. In this hypothesis he is borne out, I believe, by Doctor Ricketts.

No development work has been done below the tunnel, but diamond drills have explored the country to a depth of something like 1000 ft. below this level. What the results were are not known except to the company officials, but since the concentrator was started after the diamond drill work had been finished, it is reasonable to suppose that results were satisfactory.

Nacozari Consolidated Properties

The Pilares breccia next shows about a mile to the southeast in the workings of the Nacozari Consolidated Copper Company. This company is driving a crosscut tunnel to tap at depth the iron gossan showing in three places on the La Galera and Copper King claims. The company's main working tunnel is now in about 200 ft. and another 50 ft. will tap one of the silver-lead veins that traverse the country in a general east and west direction and lead into the Pilares breccia at the eastern termination. Until a few months ago no work had been done on the properties controlled by the Nacozari Consolidated Copper Company for nearly 20 years; then ore was shipped from the surface workings that carried 10 per cent. copper, 20 per cent. lead and 400 oz. silver.

West and southwest of this ground considerable work was done on the narrow stringers of high-grade lead-silver ore by both ancient and modern miners; but nothing of commercial importance has been developed. In this part of the district the best known properties are the San Pedro, the San Pablo, and the Moody. The San Pedro was recently leased by the Moctezuma Copper Company to Messrs. Ish, Camp, Alexander and associates, and ore is being extracted from between the 200- and 300-ft. levels. The San Pablo was worked a number of years ago, the ore being treated by lixiviation, but this did not prove a success and the mine has been closed since that time. The Moody was made the base of a stock company some time ago and work was prosecuted in a desultory fashion for a while, but nothing has been accomplished there. These silver-lead veins gain in size and in percentage of copper as they approach the Pilares uplift, but fall off correspondingly in their silver and lead contents.

The next property on which any work of interest has been done is the Bella Union lying about five miles southeast of the Pilares. This property has been worked only in the oxidized zone and the richer ores have been packed out by leasers.

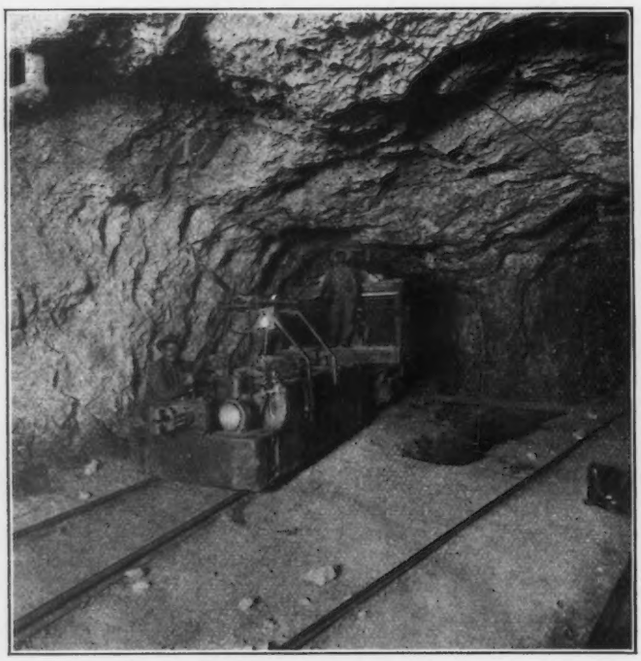
About two miles to the south of the Bella Union the Los Angeles mine of the Arizona Mining and Trading Company has been developed to a depth of about 100 ft.; but water has proved a disturbing factor, and little of interest can be expected from this place until the mine is equipped to handle the flow. The orebody shows very little on the surface, but what drifting has been done gives promise of opening up a large deposit of ore. In this property the ore is as free from the gangue as the Pilares ore, but unlike that ore it comes in bunches of almost solid pyrite, chalcopyrite, zinc blende and galena, not intermixed to any extent and all carrying good proportions of silver.

To the north of the Bella Union is lo-

cated the Copper Plate group on which some surface development has been done, and on which the showing strongly resembles that of the Pilares mine. About two miles east of the Copper Plate group the Caridad mine has been partially developed and several thousand tons of copper ore have been blocked out. The great tract of country covered by this Pilares uplift in the monzonite renders more than a mere mention of a few properties an absolute impossibility.

Second Mineral Belt

The second belt consists of a stretch of country about 10 miles long by one mile wide, of which the main mass is andesite of varying ages and accompanied by porphyry and diorite. This andesite is altered to a rock having the appearance of kaolin, in places traversed by seams of quartz and in others heavily impregnated with iron.



MOTOR WITH LOADED TRAIN, PORVENIR TUNNEL

ORE CHUTE, PILARES MINE

Traversing the belt and running with it are numerous dikes of rhyolite of considerable strength and permanence, some of them being continuous on the surface for miles. They are accompanied in places of greatest silicification by lime spar, although this rule is not by any means absolute.

Gold and silver predominate in the ores of this portion of the district, the ores generally occurring in an oxidized state, although where the dikes have attained a structure approximating quartz the ores occur as sulphide. The ores are found in the dikes with no apparent regularity as to the position on the walls or in the ground mass. The dikes themselves, however, never lose their identity as rhyolite, for in their places of greatest enrichment the phenocrysts of alkali feldspar are plainly discernable. In a few gashes and cross-fissures the ores have been concentrated by surface action, and this action is also apparent in the dikes in places, but this does not follow the zones of silicification, it being rather the opposite. The ores in these places carry more gold than silver, and are accompanied by heavy oxide of iron. Such spots of enrichment are analogous to placer deposits, and have never gone to any depth, although productive of considerable ore running into the fancy figures.

At the northwestern extremity of this belt is the Churunibabi mine of the Moctezuma Copper Company. This property was worked by the *antiguos* in years past, later by Suits & Riordan, and finally by the Moctezuma Copper Company, for its silicious ores. The property has been opened to the 500-ft. level where a heavy flow of water was struck; since that time work has been confined to the dumps and surface cuts. Development work on the mine has been limited to one of the three lodes traversing it, and in the opinion of those conversant with local conditions, it should still produce ore, probably far in excess of that mined in the past.

The next property of note to the southeast is the San José, now being worked by the San José Reduction Company, of Oakland, Cal. This property was originally worked by the ancients for the high-grade ore near the surface, and was taken up by Suits & Riordan about 10 years ago. They did considerable development work, opening up a large tonnage of $12 free-milling gold-silver rock, in addition to that extracted by them and treated in the old San Miguel mill. The property was sold to a French company who, after a period of mistakes during which they put a 10-stamp mill on the property, gave up work about seven years ago. The San José company took over the 13 claims, comprising the present property and covering about 180 acres, nearly a year ago. The addition of 15 stamps to the mill together with cyanide tanks to treat the ore crushed is reported to be planned for the immediate future. The orebodies have been opened on the vein for nearly 2000 ft., and to a depth in places of about 400 feet.

The next property now being worked in this belt on its southeast continuation is the La Mexicana mine, of the Dawson Mining Company. This property was lately taken over by the company which is now installing a 35-ton Lane slow-speed mill. Heretofore it has been worked by the Mexican owners who treated the ore in arrastras. The development on the property has not as yet attained a point which justifies a permanent reduction plant, but the ore is very evenly disseminated in a rhyolite dike upward of 5 ft. wide for a distance of about 600 ft. A shaft sunk on the vein for a depth of 75 ft. below the original outcrop shows high-grade milling ore carrying gold and silver, with no base metals.

The last property before reaching the Gran Republico fault is the El Globo, where a 1300-ft. crosscut has been run into the hill to get under the surface workings above. This tunnel has 300 ft. yet to run, which will give it a depth of 1000 ft. below the outcrop. A gash vein or fissure in the rhyolite produced some ore in the upper workings, and the shaft at that point was sunk to a depth of about 380 ft. The property is equipped with a 15-

stamp mill with two Wilfley tables and cyanide tanks. It is connected by a 12-mile wagon road with the town of Nacozari. The mine is situated on a high hill known as the Huacal mountain, the main mass of which is andesite traversed by rhyolite dikes in which the flow lines are plainly discernable.

Third Mineral Belt

The third belt has received very little attention as yet, the work consisting mainly of prospect holes sunk by the owners of the ground. At its north extremity some development has been done in an isolated body of andesite that has produced high-grade galena ores carrying considerable silver; but the formation is very open, and until the permanent zone is reached it will be impossible to say what can be expected. On the contact between the andesite and granite some isolated bunches of silver sulphides have been found that carry as high as 8000 oz. in silver and 80 oz. in gold, and a tunnel now being run to tap this contact at depth on the Gran Luz claim will be watched with much interest. For some distance to the south of this portion of the belt the formation consists of lime and a granite or syenite that has thus far yielded no permanent mineral, although along the contact the surface is copper-stained in places. Continuing to the south and almost due west of Nacozari, several large denouncements have been made by the Calumet & Arizona Mining Company and others. Work has been confined to surface tunnels and shafts, but nothing of a permanent nature has been done. Diamond drills are now in transit, and work will be instituted shortly with them on the Isabel property of C. N. Lindley. To the south of these properties and on the east slope of old Nacozari mountain the formation changes again to lime and granite; in this belt considerable work has been done from ancient to modern times on the Fortuna mine of the Moctezuma Copper Company. The ore is very base, carrying copper and silver with considerable zinc. The property is now being worked by leasers.

South of this belt some work has been done in the andesite by the Filadelfia Mining Company. The work consists of a tunnel driven in from the level of the Nacozari river on an impregnation of the andesite by sulphides of copper and iron. This property covers a lime andesite contact and promises to be of much importance in the future. The Moctezuma Copper Company is also preparing to do some work in this section on a concession that has still two years to run.

The fourth portion of the district which I have mentioned as lying about 15 miles west of Nacozari has no direct connection with the rest of the district. About 20 years ago the district was worked by James Kirk and associates and the ores partly treated there and partly freighted to Benson, Ariz. The district takes its name from the principal mine worked at that time, the Oso Negro. The ores were worked for their silver, and carried also lead, iron and zinc with some silica. These ores did not adapt themselves to the chlorination process installed there, and in the face of the transportation difficulties work was stopped, and the mines allowed to revert to the government. A few months ago the mines were re-denounced by Dr. L. L. Miner and associates of Bisbee and bonded to Sol Camp and associates of Reno and Los Angeles. Work was started on the Oso Negro vein with good results and the prospects of an early resumption of the former activities in that section are very bright. The veins are fissures in the andesite and are continuous to a good depth. They are characterized by step faults, but the ore shoots are continuous on both sides of the fault and they can be easily traced on the surface.

SURFACE PLANT, PILARES MINE

VANNER FLOOR AND CALLOW SCREENS, MOCTEZUMA MILL, NACOZARI

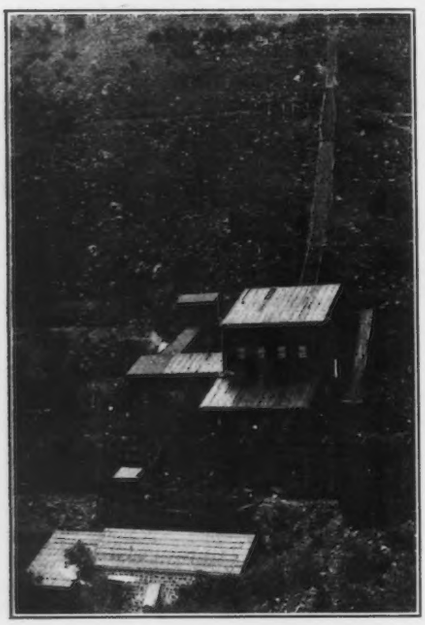
Tabotacachi District

About 25 miles east of Nacozari the Tabotacachi district has shown considerable activity in the past 18 months, but the fall in the price of copper gave this section a setback from which it has not entirely recovered. The Tabotacachi mine has been a steady producer of high-grade ore for the past two years, shipping about one car per month of silver-copper ore to the Douglas smelters. The ore occurs in a fissure in the newer andesites and has been opened to a depth of about 350 ft., from which point the shaft is being driven to the 500-ft. level. The Aliso, Credo Liberal and San Ignacio mines have been shipping carbonate ores from the upper or oxidized zone in which they resemble the Tabotacachi mine. In the Antigua and Texas mines a considerable tonnage of copper-iron sulphides, carrying some silver, has been opened up, but

has not been worked since the drop in the price of copper.

With the exception of the Belen mine operations in the Cumpas district are at the present confined to development work. The companies affected by this condition are the Transvaal Copper Mining Company and the Minneapolis Copper Company. The Transvaal company has the largest territory and its plant includes a 100-ton smelter at Cumpas. The Belen Mining Company has continued shipments of silver-copper ore to El Paso, and another class of ore, running high in silver and bismuth, has been forwarded to Swansea, Wales, via Liverpool. A Medbery furnace to treat the low-grade ores has been installed, but the power plant is being rebuilt and until that has been completed the adaptibility of the furnace will be uncertain.

The district surrounding the camp of Nacozari is the transition period when



EL GLOBO MILL AND INCLINED TRAMWAY

modern methods have but recently replaced the "gambucino" work of the early prospector. That there have been "mistakes" here as in all other mining camps is painfully evident, but where work has been done in an intelligent manner the results have been uniformly good. Labor and physical conditions are good, and the two great bugaboos of Mexican mining in the eyes of the average investor, the Yaqui and the law, are absent in the first instance and fair to foreign capital in the second. In addition to the broad campaign of development instituted at the Pilares mine by the Phelps-Dodge interests, that company is prosecuting work on other of its holdings in the district and acquiring new ground; while the field representatives of many other American and foreign companies have given the camp favorable consideration. Taken all in all, while it is yet too soon to predict the future of the district, the possibilities of the section surrounding Nacozari compare favorably with those of the more developed portions of the Southwest.

Transvaal Mining Notes

SPECIAL CORRESPONDENCE

The most noteworthy individual declaration of gold production for the month of July is that of the newly amalgamated East Rand Proprietary, which records the unexampled yield of £213,852—an increase of £13,083 over June returns, when the members of this group registered their outputs separately. A new producer will appear upon the list in August in the Aurora West, whose full mill has been started up after a long term of inactivity.

The Luipaardsvlei Estate, the leading exponent of heavy stamp practice, established a new crushing record in July. With 60 stamps and three tube mills in operation, it treated 17,120 tons—equivalent to 9.52 tons per stamp per day.

At a meeting of the Swaziland Mining and Commercial Chamber, held at Mbabane recently, the president referred optimistically to the marked development in mining which had taken place during the last fiscal year. Operations are still conducted on a small scale, but like many other outside districts, the country has witnessed a considerable increase of activity by syndicates working for mine rather than stock-exchange profits. The president observed that whereas in the preceding year only one gold and one tin mine were producing, during the last 12 months there were three batteries at work on gold quartz, one more was being constructed and three ventures were exporting tin. These concerns were responsible for gold to the value of $65,000 and 535 tons of tin ore, realizing $245,000 in all.

During the last year or so, the South African Association of Engineers, suffering from lack of support more strongly forthcoming in good times, has been criticized as almost moribund. The other societies have been able, working on more practical and less highly scientific lines, to maintain a keener interest in their proceedings. The inaugural address of the new president, E. T. Laschinger, and the discussion on papers read at the meeting last week, however, foreshadow an immediate future of more active utility and incline one to anticipate with some regret the possible amalgamation of an independent organization of such fine traditions with a society even as worthy as the Institute of Mechanical Engineers. Under the presidency of such men as Hennen Jennings, T. Reunert, the late Major Seymour and H. H. Webb, the South African Association of Engineers has seen prosperous days; but because it has largely devoted its attention to matters of primary concern to consulting engineers—civil and mining—its field has appealed but little to the general technical public, constituting the backbone of less exclusive societies.

Mr. Laschinger suggested that mining topics might most beneficially be given more thorough attention in the debates. He remarked upon the noteworthy fact that whereas metallurgical problems were so adequately thrashed out locally, mining papers of importance more frequently made their first appearance in the technical press of England and the United States, or were read before societies outside the country. This fact was the more regrettable in view of the wide scope for valuable discussions, for mining, even on the Rand's regular formation, cannot be conducted successfully on unvariable rules, but by trusting to the "alert judgment of the man on the spot" and not under any general system elaborated for him. The new president furthermore laid stress upon the educational value of writing reports, which so speedily result in revealing to the compiler the directions in which deficiencies of knowledge most urgently call for further investigation and study.

Estimation of High Furnace Temperatures

The various methods of estimating the temperature in furnaces have been studied by Dr. H. T. Barnes, of the McGill University, Montreal, (*Journ.* Soc. Chem. Ind., July 15, 1908, p. 661). As the result of these studies he states that the only satisfactory instruments for measuring high temperatures are optical pyrometers. These are of two kinds: Those which depend on color estimation, such as the Wanner, and those which depend on the measurement of the total radiation, such as the Féry pyrometer. These instruments extend in range from a low red heat up to the temperature of the sun, or 6000 deg. C. For the latter instrument, recording devices are available, similar to those used with the thermo-electric pyrometer.

It may be said in general, that for very high temperatures, from 2000 deg. F. upward, the only really reliable instrument is the optical pyrometer. For a commercial instrument reading from 2600 deg. downward to about 300 deg. or 400 deg. F., the thermo-electric pyrometer, such as the Bristol, is the most serviceable. For work below 500 deg. F. down to the temperature of liquid air, no instrument can compare with the electrical resistance pyrometer. As a standard over the whole range of temperature up to 2200 deg. F., the resistance pyrometer is recommended as the best.

Hacienda Buburon, an Old Mexican Silver Mill

Primitive Crushing and Grinding Appliances in the Guanajuato District, Predecessors of the Stamp and Tube Mills of the Modern Cyanide Plant

BY MARK R. LAMB*

One hundred years ago the Hacienda Buburon was among the most prosperous of the scores of similar plants in the neighborhood of Guanajuato. It was the nearest to La Luz by several miles, and the owner had that advantage in purchasing ores. The La Luz ores were much desired, for they contained much gold, and this was not paid for at a very high rate, since the patio process could recover only a small part of it.

The accompanying illustration of the plant shows it located near what is now a dry river, but in the old days the river ran the year around. Note that the lower water-wheel is half buried in gravel. Whatever water is now in the river flows under this gravel, fathoms deep. The flume which conveyed the power water to the plant is visible crossing a gulch back of the *hacienda*. The water ran first over a wheel in the upper end of the inclosure. The wheel is 30 ft. in diameter and furnished power for 12 heavy (for those days) stamps and also for 10 arrástras. Next the water was conducted to the second wheel of the same size which drove 12 stamps and five arrástras. A third wheel drove eight more, which are seen just on the present level of the river. Below the level of these are buried 12 large settlers, which were rope-driven, where the last possible bit of amalgam was recovered.

The third wheel was direct connected to a pumping gear.

Method of Treatment

To follow the course of the ore through the plant we must begin at the upper left-hand corner of the inclosure in front of the watch-tower. The ore came in under a strong guard, for Guanajuato was noted in those days for its bold bandits. Conditions were as they were in Goldfield not long ago. Ore and bullion would be stolen from one mine and could be sold to a neighbor with no questions asked. In this upper inclosure the ore was broken roughly by hand. From the small heaps of ore still on the ground it is estimated that before being fed to the stamps the ore would pass 1-in. mesh. It was then put in a bin back of the first battery preparatory to fine crushing.

Part of the coarse ore was crushed in a curious cast-iron breaker before being fed to the battery. This breaker was none too strong; so instead of being rigid, it was fitted with a long weighted lever on each side of the swinging jaw. In case the ore was particularly hard, or a hammer was dropped into the breaker the weight would lift and thus relieve the strain on the jaw.

"Of course, the breaker would work thus," the old man about the place told me, "even if it were not an accident; so when no one was near, the boys feeding the breaker would compete in throwing the weights."

HACIENDA BUBURON, AN OLD MEXICAN SILVER REDUCTION PLANT

The stamps of battery No. 1 are oak timbers about 4 in. square. There was a foot-board near the top of the stems and handles by which they were lifted by hand for repairs. These stems were fitted with cast-iron shoes, none of which remain. The wearing part of the shoes was 1 in. thick and was cast with a rough socket into which each stem had to be fitted. The stamps drop on a cast-iron block 8 in. wide, 6 in. thick, and long enough to reach three stamps. These dies seem to have been placed once for all and never to have been renewed. Battery No. 1 was driven by a rope from the first water-wheel. The cam shaft is 3 in. in diameter; it has a key way its full length and has 12 three-arm cams keyed on and ar-

*Mining engineer, Mexico, D. F., Mexico.

ranged to give a 1-2-3-4-5-6-sequence of drop. A rounded block of oak set in the end of each arm engaged an oak pin set into the stem. No arrangement was made to shift the tappets for wear. Perhaps there was no wear. Battery No. 2 has a cast-iron drum for a cam-shaft provided with similar sockets for retaining the oak cams. This seems to be an intermediate type between the log cam-shaft used in the *really old* mills, and the shaft on battery No. 1; so I have concluded that the shaft and cams of the latter were of the very latest type.

A Leisurely Process

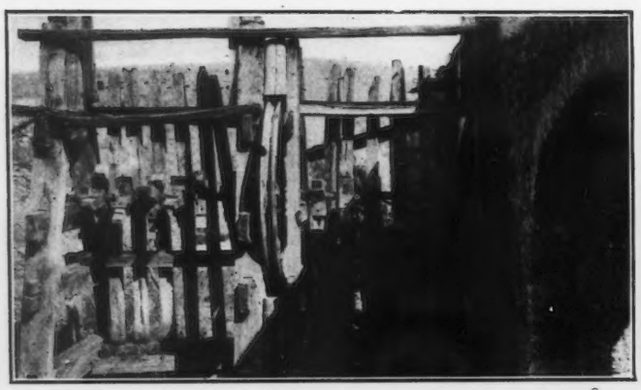
The batteries were operated with no inclosing mortar, and crushed dry. Horizontal screens of punched rawhide were arranged on both sides of the die. The holes in this were less than 0.25 in. The battery-man would feed from one side for a time, meanwhile scratching the screen with a little wooden rake and tossing the over-size back on the die. While he was on one side the other screen would be accumulating a pile of crushed rock, so he alternated between the screens. Since the capacity of the mill of 12 stamps was 2400 lb. per day the job was not very strenuous.

The crushed ore was then fed in charges into the arrástras, and enough water was added to make a thick pulp. After considerable grinding this pulp was sprinkled slowly, thoroughly and minutely with *pella de cobre*, a sort of silver and copper amalgam. The man having this work in charge would work down the row of arrástras riding on one of the slow-moving grinding stones while sprinkling the amalgam into the pulp with great care. Notched drag-arms were arranged to prevent the drag-stones from working to the center. This method of grinding was particularly suitable for this method of amalgamation, for no iron was added to the charge, and at the same time any desired degree of fineness could be attained. A large portion of the metal was caught in the quiet parts of the bed of this grinder, and with silver ores the amalgam, as it came from the corners and crevices, was worth $5 per lb. With ores containing gold this value was increased, as the gold saved was all caught here. Guard-houses were placed at each end of the rows of arrástras, as the amalgam was easily stolen. In those days little note was taken of an occasional shooting in the *haciendas*.

Careful and continuous tests were made separately of the pulp in each mill, and as soon as the reaction between the copper amalgam and the silver mineral was practically complete, the pulp was discharged into settling pits to drain and dry. Several of these pits are seen at the left of the general view. After drying to a thick mud, the pulp was drawn to the patio and there *castigado*. The proper reagents were added and the mass worked over by droves of mules walking around through it for perhaps a month. Sampling was continuous and washing and testing samples to ascertain the condition of the torta was a vital necessity. It might get "hot" when lime would be added; or it might get "cold" when more iron and copper salts would be needed. In Guanajuato the drivers of the mules were obliged to walk, but in Pachuca, where the weather is much colder in winter, they were permitted to ride.

From the patio, after the amalgamation and treatment of the ore was complete, the pulp was fed into a series of agitators and thinned with water. The amalgam settled out and the tailings overflowed to the river. Even these tailings have a slight value, and were sold to men skilled in concentration; they built *planillas* near the tailings outlet and washed out the last possible grain of *polvillo*. This concentrate was worked over on a very small scale exactly as a *patio torta*, except that roasting preceded amalgamation.

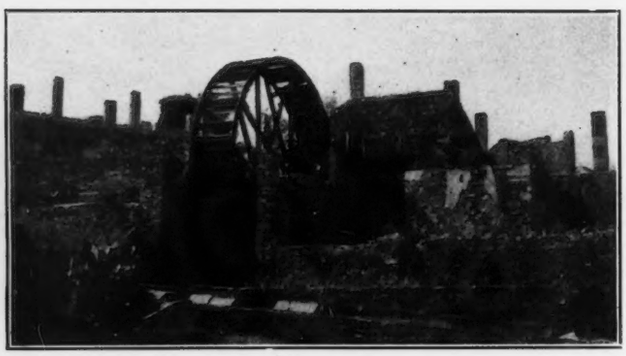
The patio of this plant is under gravel, and only a few inches of the top of the high boundary wall now show above the surface of the sand in the center of the present river bed. Although there was a roof over the entire plant, nothing is now left of it but the supporting walls and pillars.



TWELVE-STAMP BATTERY, ROPE DRIVEN

POWER-DRIVEN ARRASTRAS

POWER WHEEL AND PUMP PINION



WATER WHEEL, STAMPS AND ARRASTRAS

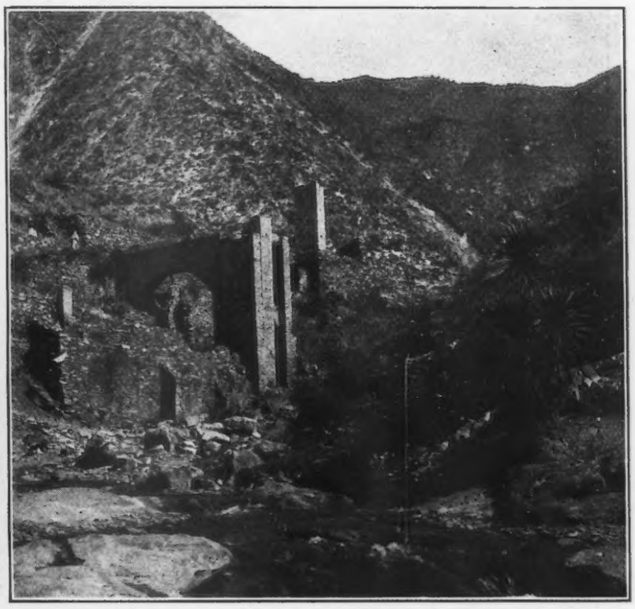
Mining in Mexico, Past and Present

Spanish Search for the Precious Metals. Early Methods of Mining and Reducing Ores, and Their Results. The Mexican Miner, His Work

BY E. A. H. TAYS*

Within a very few years after Cortez had conquered the country surrounding the present City of Mexico the Spanish had overrun the greater part of the American continent south of the northern boundary of the United States. The prime motive for this extensive exploration, accompanied always with the greatest hardship, danger and privation, was not to add new lands to the Spanish domain, nor to spread the knowledge of the Christian religion among the natives. It was greed for wealth, and the reason the explorations were so extensive and carried out practically within 30 years—much of it within 15 years—after the first landing of the Spaniard, was due to the fact that the wily natives early recognized that the Spaniard's whole desire was wealth, and having had a taste of his methods in the conquest of the valley of Mexico, they told the conqueror fairy tales of "El Dorados," which the Spaniard always found to be farther ahead, and thus he was led by a mythical ignis fatuus far up into the desert north seeking wealth—gold and silver.

MACONI, LOOKING TOWARD EL DOCTOR MINE



OLD SPANISH WATER-TOWER BLOWER

Search for the Precious Metals

So great was the Spaniard's greed for silver, and so relentless his methods of enslaving the natives, forcing them to work the mines when found, that to this day no true Indian will show anyone a mine. The superstitious belief is that the Indian who makes known the location of a mine will die. It is very easy to follow back this reasoning to its source.

Though Mexico has vast natural agricultural and allied resources, still it is and will be, for years to come, essentially a mining country; and although millions in bullion have been produced, the beginning is only just at hand.

The early Spaniard, and his descendants, were very thorough in their search for the precious metals, and though, undoubtedly, many new mines will be discovered, nevertheless it is remarkable how few of the ledges found today show no signs of a former visit.

There is a standard tradition in Mexico today which the local sage always applies to the discovery of any celebrated ore producer in his section. As this tradition goes, either some *arrieros* stopped for the night, or some lone traveler was forced by the darkness to make his camp fire on the spot, and in the morning found the rocks under or near the fire covered with pellets of silver. I know of one authentic case of a valuable mine being discovered in a somewhat similar way in recent years; but in this case, the Grageda mine in western Chihuahua, a dead oak tree was set afire and several days afterward the parties, by chance, overturned some projecting rocks on the spot, and breaking one, found it to be silver ore.

The now famous camp of San José de Gracia was discovered in a unique way. On top of the hill, now known as "El Copo," a ledge cropped and some Indians living there used the flag-like broken croppings to build a goat corral. In the thirties a party of packers on the way to Guadalupe y Calvo, in Chihuahua, passing by, noticed the corral was made of quartz rock, and one of them, picking up a piece, was surprised to find it well spotted with gold. Here was discovered the Mina Grande bonanza, which gave birth to the camp, although Mina Grande is an unworked prospect today.

One of the favorite superstitions in regard to mines and buried treasure, and one religiously believed in by the native Mexican to this day, is, that where either exists, flames will arise from the spot at certain times of the year.

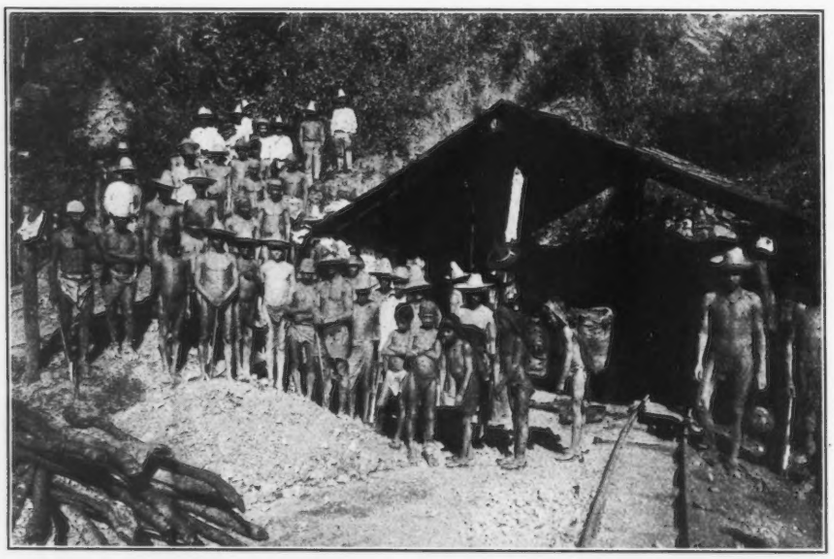
Early Mining

In the early days mining operations were carried on in the most primitive way. As there was no hoisting machinery but the primitive *malacate*, a horse windlass, few shafts were attempted; and where horizontal adits were impracticable, the orebody was followed down by the *pozo y patilla* method, which was to sink winzes from 15 to 30 ft., then drift a like distance, usually on an incline. This method was sometimes carried to respectable depths.

Although shafts of any depth were un-

*Mining engineer, San Blas, Sinaloa, Mex.

usual, nevertheless there are several in the Guanajuato district that are marvels, when we take into consideration the methods by which they were sunk. Take, for instance, the Valenciana, 1800 ft. deep, with an octagonal section 28 ft. in diameter, sunk with black powder and all material hoisted by horse windlass equipped with rawhide ropes and leather buckets. The idea of making it octagonal was with the view of placing a hoist at each of the eight sides.



MINERS AND TANATEROS AT A MEXICAN MINE, 10 YEARS AGO

Later, in the last half of the nineteenth century, four steam hoists were placed at this shaft and these were operated up to 15 or 20 years ago.

On the west coast, up to 20 years ago a vertical shaft was almost unknown, but this, in part, was due to the nature of the country, which lends itself to exploration by adits. In fact, so few are the shafts, that I have had trouble in getting men to work in a shaft sunk but 250 ft. The same fellows, who would crouch down in the bucket, at first, when lowered, a little later on would be found coming up four at a time on a loaded bucket, and would fail to comprehend orders to the contrary.

In early days, and not very far back either, such a thing as a windlass on a winze or a wheelbarrow in a stope or level, were unknown. All waste and ore were taken to the surface on men's backs, in leather bags called *tanates* or *zurrones*, and the laborer performing this work is called a *tanatero*.

They start in as very small boys, when they can hardly carry 25 lb. and are called *buques*, and work by degrees up to a load of 150 lb. The ordinary grown *tanatero* will climb up vertical ladders, on the *pozo y patilla* order—steps of 20 to 30 ft.—several hundred feet. I call to mind one mine where ore was, up to a few years ago, carried up a 1000-ft. shaft on a 36-deg. angle. An electric hoist now does that work.

Close Working in Former Mines

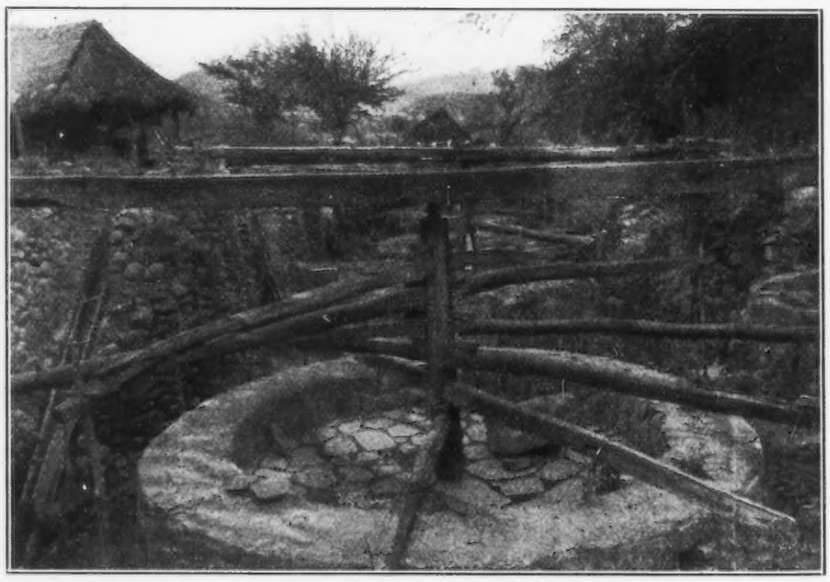
On account of the crude methods of mining the modern foreigner usually thinks that only the richest of ores could have been worked; but he does not take into account that the dominant class in Mexico, from the conquest up to 20 years ago, had the Indian, the native, practically enslaved, and all such work cost but little. This is the reason for the present belief that all old mines, the *antiguas* as they are called, found abandoned have only to be cleaned out to continue profitable production. Such may often prove to be the case, but the mines have seldom been abandoned because the native could not work the ore on account of its low grade. Usually the reason has been lack of ore, or of values in the ore. Faulting is often the cause, as this natural phenomenon was little understood in early days.

As an illustration of what grade of ore the native of today sometimes works, I will give a personal reminiscence. A few years ago while traveling in the mountains of eastern Sinaloa, in an out-of-the-way gulch I stopped at a little camp composed of two or three huts. As I saw five arrastres being operated on the arroyo's edge, run by burro power, I made inquiries and from the result of these took a look at the ledge from which the ore was taken. This was a fine quartz ledge fully 5 ft. wide and had been worked by open trench, along its outcrop, for 500 or 600 ft., and to a depth of 50 ft. in places. I liked the looks of the ledge so much that I took several samples from the working faces.

I found that the miner with four sons was working the ledge, the output of the five burro-driven arrastres being about two tons per week. He told me that in the rainy season he planted a little corn and in the dry season worked the mine, from which he took 250 to 300 pesos each season, which supplied the family with clothes, etc. My assays, made later, showed that the ore carried but a little over $5 gold per ton. Not much picking in this for the scientific foreigner.

Ore Stealing

One of the great troubles in working high-grade ores in Mexico is the prevalence of high-grading. The native miner does not look on this as stealing. Any rich ore encountered he figures on as his.



ARRASTRES RUN BY WATER POWER

I have often had them say, in telling of some special find in a stope where they might be working, in a mine not their own, "y Dios me dio"—and God gave me. The nugget they, of course, purloined. They show great ingenuity in getting away with the ore, even when working naked in the mine and being searched on coming out. In a large mine where there is more or less rich ore the loss is con-

siderable. Imprisonment has no horrors for the native miner. The only thing I have ever found that seemed to affect them, and which cut the evil down greatly, was black-listing them. Anyone found with ore on his person or otherwise was black-listed, and, as far as that mine was concerned, was never given work again. I have had fellows beg, with tears in their eyes, to be allowed to return to work. When others found out that the black-list really meant that they would never be employed again, the stealing notably diminished.

"Follow your ore," seemed to be the motto of the *antiguos,* and it is a good one to follow to-day; but the old methods are not to be recommended. I know of a mine, several in fact, that for a number of years produced large sums—a million a year—that never had $100,000 worth of ore actually available at one time.

The Patio Process

Mexico has the honor of having to the credit of one of its sons, Bartolomé de Medina, the invention of the first practical treatment for silver ores. This was the patio process, invented in Pachuca in 1557. This was the standard method of treating silver ores, not smelted, for 300 years.

Then the Comstock came into being, and to an American was due the invention of the pan-amalgamation process, which so modified the old patio process that where the old way took days, the new cut it down to hours.

Smelting Silver Ores

In early days Mexico had made advances in smelting silver-lead ores in a small way; and one often runs across adobe stacks—by courtesy—in which quite creditable work was done. Refining is done almost universally, even today, in the well known *vaso.* I have seen a furnace, running day and night, where man power was used for the blast. The power was applied with the foot supplemented with the weight of the body. Relays were every two hours.

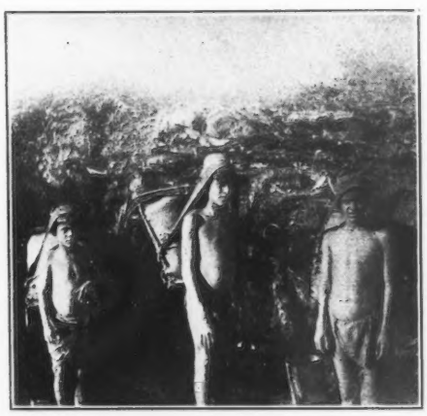
The Spaniard early learned to use a unique water compressor which furnished pressure enough to give sufficient blast. I have seen a number of these old compressor towers in different parts of Mexico, but none on the west coast.

Change in Methods

Up to a few years ago the *Tahona de arrastre*—arrastra, as contracted into English—was the universal grinder in Mexico for treating gold ores. Some of these were run by water power. But from a modern viewpoint they were of small capacity at best, though efficient amalgamators.

Great changes have taken place within the last 10 years, and, although the native mine operator was at first slow to make changes, the object lessons given him by the foreign operator were speedily learned. I call to mind an illustration of the conservative ideas of the native mine-owner. Some years ago an American engineer was putting in a small stamp mill for a Mexican miner in western Chihuahua. When about finished the engineer asked old Don Martin if he should not arrange for an assay office. "An assay office!" the old man exclaimed, "What do I want of that?" "So as to know how your ores are running," replied the engineer. "No," said the old man, "that would show me what I was losing, and that would make me mad. No, I do not want an assay office."

Sentiment of this nature is dying out, and in the past few years Mexico has made great changes for the better, and some of the largest and most scientific plants are to be found in Mexico. The pan mill replaced the patio process, and now cyanide practice promises to make them both obsolete. Smelting is carried on on the most advanced lines, and



BUGUES AT TODOS SANTOS

the day of the arrastra and the man-blast furnace is about done.

Native Miners

The native miner is a curious study. He is hospitable and improvident, superstitious and reckless; is in fact a fatalist. He will work hard, and when treated properly, responds by a frank adherence to his *patron,* though in the mine he will rob him blind; but then, finds of that kind are God-given, according to his reasoning, and that is not stealing.

Being fatalists, "today," is their motto, and all kinds of games are rife at a live Mexican camp; and from two to three bands of music can always be counted on, for our man revels in a Roman holiday, and he weaves many in with those of ordinary run.

Railroads and Changes

Modern railway lines are now being run in unaccustomed parts, and within a very short time it will be possible to build mining and reduction plants as well and cheaply as elsewhere; and the day when the freight on the plant was more than its first cost is fast disappearing.

Silver Cyaniding in Mexico

By J. B. Empson*

The price of silver has reached a point where the successful and economical operation of small properties, or those that contain large bodies of low-grade ore, cannot be operated at a profit. In the opinion of some the solution of the difficulty lies in seeking greater efficiency in extracting the metal from the ore and in reducing costs of production, rather than in awaiting the time when silver will rise in value, and remain more or less constantly at higher figures.

Now that the cyanide process has been applied to the extraction of silver as well as gold, a far larger supply of silver produced at a lower cost than has formerly been practicable will reach the market. Hence, since the price of silver, unlike that of gold, is regulated slowly by the supply and demand, the properties which will be successful in the future will be those which can produce silver at the lowest cost. The problem is, therefore, one for the metallurgists to solve. By more efficient methods, more automatic appliances, better applied chemistry, they will make the production of silver at a lower cost possible. While silver at 52c. per oz. is today looked upon by some companies as too low for successful operation, it may be that in the course of the next year or so, this price will mean good profits for companies employing modern methods.

The production of cheaper silver may be accomplished either by reducing costs or by increasing extraction.

Mining Costs.

In Mexico the cost of mining is largely governed by local conditions, such as distance from railroad, class of labor obtainable in the district, and, last but by no means least, the executive ability and experience of the man in charge of operations. The manager's ability to get the best results from the native labor employed, his experience along the lines of labor-saving devices, his capacity for meeting and overcoming difficulties as they arise, and his ability to distinguish the difference between true and false economy, will often make the difference between the high or low cost per ton of ore mined. A mine superintendent in Mexico has very often to rely entirely on his own resources, especially in small mines where he may be the only white man employed.

It is a very common mistake in mining operations in Mexico to ignore the fact that because labor is cheap it does not necessarily follow that it can be used indiscriminately. Frequently manual labor is used for all kinds of odd jobs simply because labor is cheap. The labor bill

*Consulting engineer, Mexico City, Mexico.

thus incurred, although spread over a large number of names, becomes of considerable importance when added to the weekly total. Besides, the larger the number of men employed, the greater the trouble of keeping the work going, especially on Sundays and on fiesta days. Another practice followed in some mines in Mexico, which from a theoretical point of view is good, is the system of piecework, in particular of paying for drill holes at so much a meter or part of a meter drilled. This method, although economical in mines where white shift-bosses are employed, becomes dangerous where Mexican *cabos* measure the holes. The *cabos* or native shift-bosses are apt to "stand in" with the miners. In these cases it is better to contract by the meter driven or sunk rather than by the hole measured.

Rapid Cyaniding by Agitation and Aeration

It has been proved by a number of practical tests carried out during the past six months, that on clean silver-sulphide ores obtained from various silver camps in Mexico it is possible to obtain 93 to 97

Hours of Agitation.	Assay in Grams.		Total per Cent. Extraction.	
	Silver.	Gold.	Silver.	Gold.
0	1215	4.5	....	....
6	136	0.5	88.8	88.8
12	102	0.5	91.5	88.8
18	64	0.25	94.7	94.4
24	81	0.5	93.3	88.8
30	49	0.5	95.9	88.8
36	46	trace	96.6	....
42	46	trace	96.6	....
48	37	trace	96.9	....

per cent. extraction, in a period ranging from 36 to 48 hours in place of the 14 to 21 days' treatment as now practiced. Not only was the extraction obtained in a much shorter time, but in the majority of cases the results were obtained without preliminary concentration. This apparently opens up a new field for silver cyaniding, which will play a considerable part in lowering costs of production of the metal. The tests were all made upon lots of 100 kg. of ore. Each test was made separately and the results were checked. In every case the ore was treated without preliminary concentration, and in each case the tailings after cyaniding were concentrated. With the exception of two cases, the results obtained by concentrating were negative. Two lots of ore showed an extraction by concentration of 1.8 and 2 per cent. of the total silver in the ore. The consumption of cyanide was normal in all cases with the exception of two lots of old dump ore, which contained a considerable amount of ferrous salts. Considerable difficulty was experienced in completely washing out the soluble metal contained in the pulp in the large sample used for the purposes of the concentration test. In some cases the tailings obtained after concentration were of greater value than the tailings resulting from the cyanide treatment.

A lot consisting of 100 kg. of ore from the San Rafael mine, Pachuca, and containing 1215 grams silver and 4.5 grams gold was ground to 150 mesh and treated by agitation for 48 hours. At intervals of six hours the pulp was assayed with the result shown in the accompanying table.

The cyanide solution extracted in all 1178 grams silver and 4.49 grams gold, representing a total extraction of 97.3 per cent. of the value of the metals. The strength of the solution before treatment was 0.38 per cent. and after treatment 0.33 per cent, representing a consumption of one kilogram cyanide per ton of ore. The amount of lead accetate added amounted to 30 grams.

The essential factors in this method of rapid cyaniding are: (1) Fine grinding of the ore so that at least 85 per cent. of the sand will pass a 200-mesh screen, and that all will pass a 150-mesh screen; (2) complete agitation and aëration of the pulp in cyanide solution. By complete agitation and aëration is meant the most complete aëration and agitation known at the present day. To accomplish this, it will be necessary to use the air-lift principle in deep tanks of small diameter, such as are at present in use in the Pachuca camp.

This agitation can be accomplished with a consumption of 1¾ h.p. per tank containing 100 tons of solids, mixed with cyanide solution in the proportion of two of solution to one of solids. From 10 to 15 h.p. are required for mechanical agitation. Hence there is a great saving in the power used, as well as a considerable gain in the extraction. These tanks, I understand, are in use in New Zealand where F. C. Brown, their inventor, has them installed at the Grand Junction mine at Waihi. Extremely good results are obtained there from their operation. There are two installations of these tanks at Pachuca, Mexico, five being installed at the Hacienda de San Francisco, and ten at the new mill of the San Raphael y Anexas at the same place.

The third requirement in this method of treatment is the most efficient slime filters at present available. The successful slime filter to cope with conditions, such as a plant of this nature calls for, will be one that will thoroughly displace the dissolved silver contained with moisture in the cake. This can only be done when the washes are entirely barren.

Electric Precipitation

Another point, which though not essential to the working of the process may yet require serious consideration, especially as applied to silver cyaniding is the use of electric precipitation instead of the zinc-shaving precipitation now generally used. As far as I know the electric precipitation has been mostly used in the past on ores that carry chiefly gold, and but comparatively little work has been done on these lines in the cyaniding of silver ores. The mines of C. Butters at Minas Prietas and Creston Colorado have been using this process for some time, with good success. When it is borne in mind that for every kilogram of silver recovered in the usual method, there is a consumption of zinc ranging according to conditions from 1½ to 3 kg. and estimating zinc shavings to be worth 55c. per kg. we have a cost per kilogram of bullion won, of from 77c. to 1. Taking a 65-peso silver ore containing 500 grams of silver, the charge for zinc per ton of ore treated (eliminating the loss due to non-extraction) would be 38.5 to 82.5 cents. This is a strong argument in favor of electric precipitation, the cost of which is about 24c. per ton of ore. The costs of electric precipitation will vary according to the price of power.

Another point in favor of electric precipitation is that the solutions cannot become charged with the double cyanide of zinc, an important point when cyaniding fairly high-grade silver ores.

Spanish Mineral Exports

Exports of ores and minerals from Spain for the seven months ended July 31 are reported by the *Revista Minera* as below, in metric tons:

	1907.	1908.	Changes.
Iron ore	5,438,205	4,624,424	D. 813,781
Copper ore	780,256	711,722	D. 68,534
Zinc ore	95,822	65,087	D. 30,735
Lead ore	3,918	1,941	D. 1,977
Manganese ore	50,943	13,191	D. 37,752
Pyrites	772,010	873,883	I. 101,873
Salt	309,607	393,781	I. 84,174

The large decreases in iron ore and the other metallic ores are further indications of the general depression in business throughout Europe. The British iron-masters, as a rule, draw largely on Spain for their ores, but this year have much reduced their purchases.

Exports of metals for the seven months were as follows, in metric tons:

	1907.	1908.	Changes.
Pig and manu. iron	32,946	18,283	D. 14,663
Copper	4,477	6,508	I. 2,031
Copper precipitate	9,650	12,928	I. 3,278
Zinc	765	812	I. 47
Lead	107,113	110,055	I. 2,942
Quicksilver	1,482	1,491	I. 9

Unlike ores, the metal exports generally show an increase in quantity.

Gold in New Zealand

The Mines Department reports the exports of gold in May at 45,017 oz. bullion, a decrease of 10,668 oz. from May, 1907. For the five months ended May 31, the total was 199,772 oz. bullion in 1907, and 207,399 oz. in 1908; an increase of 7627 oz. The bullion reported this year was equal to $3,977,596, or 192,433 oz. fine gold.

Silver exports in May were 265,450 oz. in 1907, and 164,635 oz. in 1908; a decrease of 100,815 oz. this year.

Guanajuato, the Great Silver Camp of Mexico

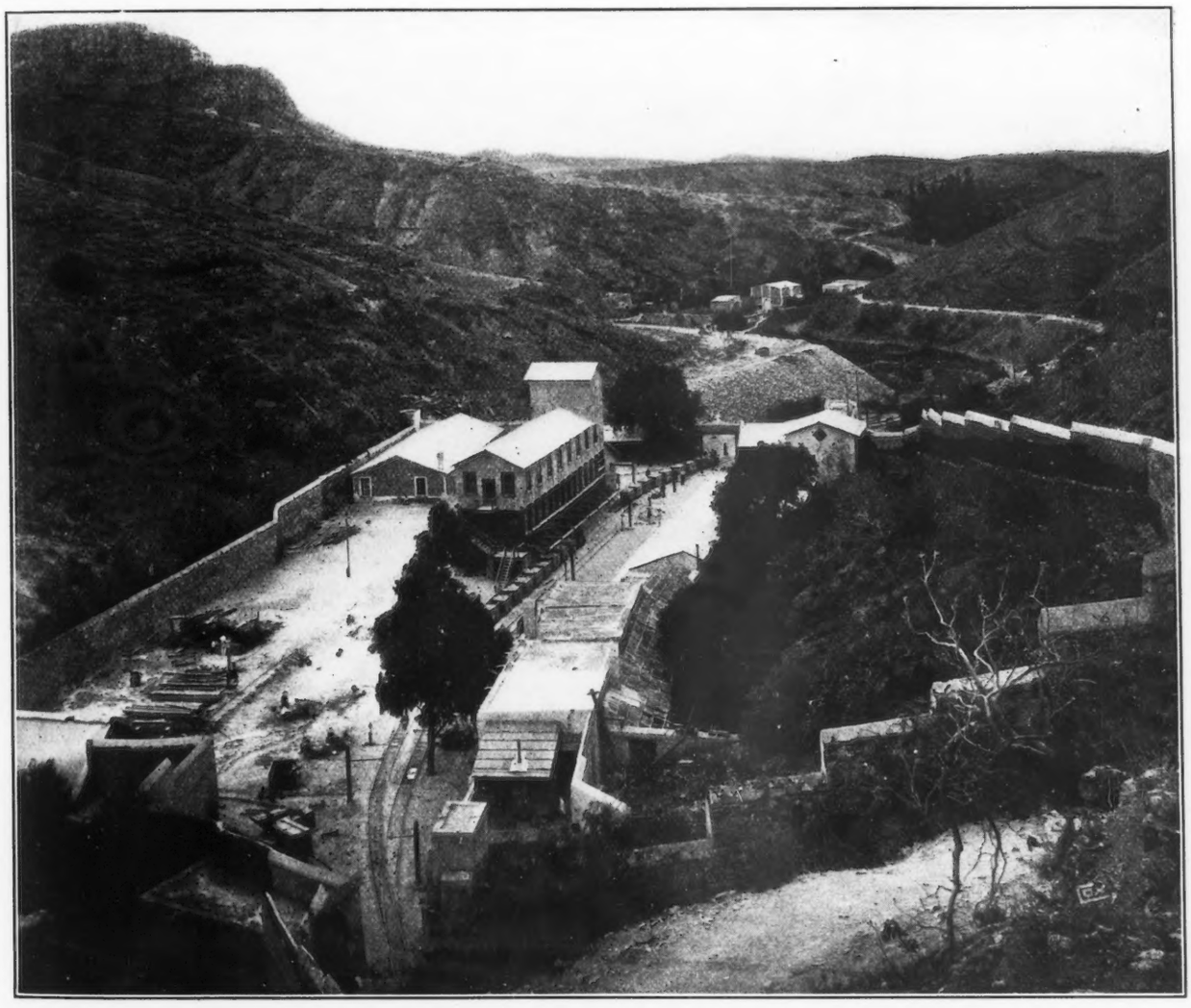
Ore Now Milled Comes Mainly from Dumps, but the Mine Tonnage Is Increasing and the Veta Madre Mines Are Being Reopened

BY CLAUDE T. RICE

The city of Guanajuato, which has a population of about 45,000, is situated on the short branch of the Mexican Central that leaves the main line at Silao.

The magnificent churches, offerings of pious miners, the beautiful public buildings and residences, and the quaint old surroundings make Guanajuato probably the most picturesque mining city in Mexico. It was the first city that Hidalgo's forces took in the war of independence. This war killed mining at Guanajuato and other mining camps during the years that it lasted. When mining resumed, it was English capital at Guanajuato, Pachuca, El Oro and Zacatecas that reopened many of the best mines.

Guanajuato is situated in a gulch below the meeting of several other gulches. The whole country is steep and rugged. After a heavy rain the streams in these gulches suddenly become torrents; consequently the city has been visited by several disastrous floods, the last of which occurred July 1, 1905. Since that time the Porfirio Diaz tunnel, 2000 m. long and more than 6 m. in diameter, has been driven to carry sudden rushes of water through it and away from the town.



THE PATIO AT THE SIRENA MINE, GUANAJUATO

The Mines of the District

The ore in the mines of Guanajuato has been very rich; the mines have produced immensely; many men have become rich and have been ennobled on account of the bonanzas found along the Veta Madre, the mother lode of Guanajuato. The production of the mines has been enormous, and around them has grown up a history full of romance. The romance of the past has begot the romance of the present. As a result Guanajuato is the most advertised mining district in Mexico. The drop in the price of silver has done a good deal toward sifting the grain from the chaff and several companies have shut down, leaving the Guanajuato Consolidated Mining and Milling Company, the Guanajuato Development Company, the Guanajuato Mines and Reduction Company and the Guanajuato Amalgamated Gold Mines Company conspicuous as the solid companies of the camp.

Guanajuato's modern mining industry is

a development of the past; only one new lode—the Carmen-Pinguico vein—has been found and developed in recent years. The other companies are working the old properties mined years ago, for the cyanide process and electric power have rendered valuable ore that formerly would not pay for working.

Nothing is more tedious than unwatering and putting in shape a large mine that has been shut down for years, and the mines of Guanajuato have been slow in resuming production. The Sirena mine of the Guanajuato Consolidated, as it was the first to be re-opened and as it was not as extensively worked in the past as some of the others, is now in good working order. The Guanajuato Consolidated and the Pinguico Mines Company, a subsidiary company of the Guanajuato Development Company, are treating mine ore, but much, if not most of the ore treated at the other properties comes from the dumps. Many of the companies have been equipped with more stamps than the development warranted and so there has been continual scratching in the mines to keep ahead of the mills.

CITY OF GUANAJUATO AND SURROUNDING COUNTRY FROM THE SOUTHWEST

History

Ore was first discovered at Guanajuato in 1548 by some muleteers on their way to Zacatecas. The ore was found in La Luz, the western part of the district, and the San Bernabé mine was opened up. Two years later Juan de Rayas, a muledriver, discovered the Veta Madre and gave his name to the Rayas mine. Work was started on the Rayas and the Mellada mines at the same time, April, 1550, so that these are the oldest mines on the Veta Madre. But it was not until 1768 that the ore was traced far enough to the northward to find the rich ore in the Valenciana.

During the eighteenth century the Veta Madre mines were the scene of most of the mining, and many men were ennobled on account of the richness of the orebodies found in the Valenciana, Cata and Rayas mines. The Sirena mine also produced a large amount of ore, but the Sirena, although having a far more glorious present than the others, was not so conspicuous in the past. From 1810 to 1829 the mines of Guanajuato did not produce much ore. About 1843 the veins at La Luz began to produce heavily.

About 1825 the Anglo-Mexican Company and the United Mexican Mining Company, both English, entered the district, but they seem to have left little impression on the camp. The Anglo-Mexican company worked the Valenciana, Concepcion, and other mines; the United Mexican worked the Rayas, the Secho, the Cata, and other mines, and even as late as 1881 paid a dividend from ore mined in the San Cayetano adit. These two were the only foreign companies that had operated in the district prior to 1898 when the Guanajuato Consolidated Mining and Milling Company entered the district, which was then practically dead.

Production

The production of Guanajuato is estimated by a government publication to have been 279,000,000 pesos from 1701 to 1800, and from 1800 to 1900, 231,137,013 pesos. The most productive years in the history of Guanajuato have been 1791, 1804, 1849, 1850 and 1852. The first period is the time when the Valenciana was making its largest production, and the last three years, those during which La Luz and the San José de los Muchachos mines were producing bonanza ore.

From 1852 until 1898 the output slowly declined as the extraction from the ore by the patio process decreased. In 1898 it consisted mainly of *gambucino* work in a few of the larger mines. The *patios*, which were situated along the river between Guanajuato and Marfil, ran fairly continuously during the summer months, for then the extraction was greater than during colder weather, but in winter they ran only occasionally. Most of the mines were owned by Mexicans, who were also interested in the *haciendas*. In fact 12 years ago, when M. E. MacDonald began to work the Sirena mine, there were only 30 to 35 *patios* making any pretence at working. The ore, that the Mexicans were treating in the *patio*, assayed about 30 oz. silver and 0.4 to 0.5 oz. gold per ton, for, while some of the larger *haciendas* could treat ore at 13.50 pesos, at many of them the cost was 17.50 pesos. Ore that assayed much higher than this was shipped; at that time the shipped ore amounted to about 1000 metric tons per month.

Modern Operations

In 1896 or 1897 the MacDonalds entered the district; in 1898 the Guanajuato Consolidated Mining and Milling Company, organized by them, purchased the old Sirena mine. They erected a pan-amalgamation mill to treat the ore. This and the small Nayal mill were the only pan-amalgamation mills in the district.

The awakening in the district came in 1905 when the success of cyanidation of the ore was proved. Experiments by E. M. Hamilton of Chas. Butters & Co., had demonstrated in 1902 the feasibility of cyaniding the ore; but even with the experience gained at El Oro, where considerable silver occurs in the ore, and the experience of cyaniding Comstock ore, which also carries considerable silver, the Consolidated company continued to treat the ore by pan-amalgamation and retained its mill in readiness for running until the success of the cyanide process was clearly proved. In 1906 and 1907 several mills were built in the district; all retain the old sand and slime treatment, although gradually an all-sliming process is being approached.

Geology

The geology of the district has been the subject of much study, and each investigator appears to come to some new conclusion either regarding the age or the origin of the rocks.

The rocks forming most of the mineralized area which extends 13 miles north-

west-southeast and 10 miles northeast-southwest are argillaceous schists, slates, and calcareous conglomerates. The schists vary in color greatly, being yellowish green, gray or red. The deepest member of the series is generally a black slate. These sediments have all been greatly folded.

According to the older theory, after this folding there was the formation of a large thickness of red agglomerate generally called locally a conglomerate, which in many places has a strike between north 30 and north 40 deg. west, with a dip varying from 10 to 40 deg. toward the northeast. In the upper part of the red agglomerate in La Luz part of the district was intruded a granite laccolith. Younger than the red agglomerate are the rhyolite and rhyolite breccias, while later than the rhyolite is a capping of andesite and andesitic breccia.

According to the newer theory worked out by C. W. Botsford, who has studied the geology of the district more closely than anyone else, and indorsed by John A. Church, the agglomerates and schists are of the same age, the schists being merely a propylitic alteration of the agglomerates. This alteration has been more thorough in the lower part of the agglomerates than in the upper part. Taken together, the thickness of these agglomerates and schists is over 3000 ft.[1]

The main direction of fracturing at Guanajuato has a strike varying between north 30 and north 60 deg. west with a dip varying between 45 and 75 deg. to the southwest, rarely to the northeast. The main veins were formed along this system. A less important system was developed at right angles to these; only rarely has much ore formed along these fractures.

Ore Zones

There are three main ore zones at Guanajuato, the Veta Madre in the center, the Sierra system on the east, and La Luz system on the west. The Veta Madre is the most important, while La Luz is next in importance.

The Veta Madre is an immense vein about three miles long and from 20 to 300 ft. wide; it has a general northwest strike and dips from 45 to 55 deg. to the southwest. The hanging wall of the fissure has been dropped more than 1000 ft. Along most of its length both walls are the red agglomerate; at depth this changes to the schists, and at still greater depth black slate forms the footwall. The ore occurs in three zones: one near the hanging wall, one near the footwall, and one in the center; sometimes one occurs, sometimes two; rarely the ore extends from wall to wall. The richest ore is found just below the intersection of cross-veins and fractures on the hanging-wall side. The most productive area of the Veta Madre has been from the Rayas to the Valenciana mine.

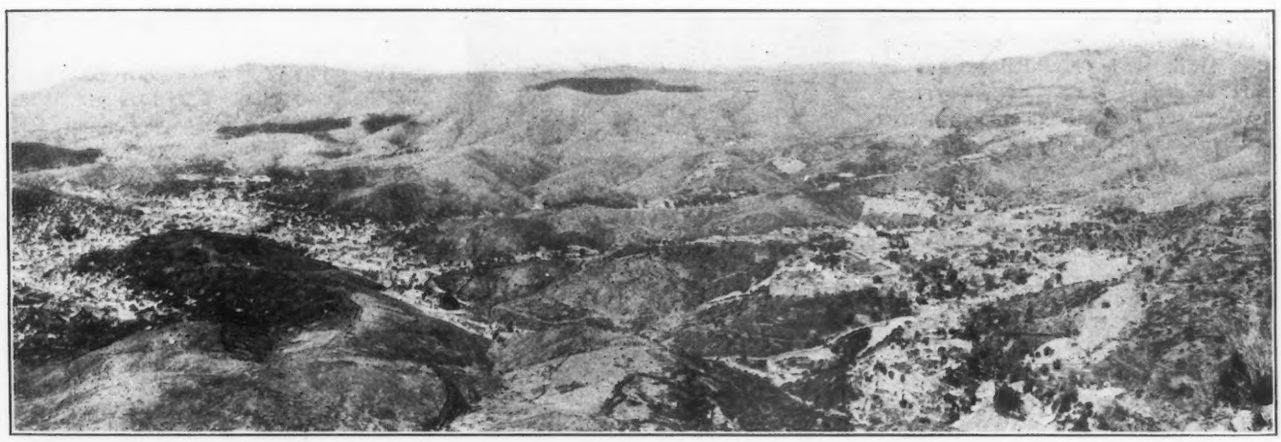
The veins of the Sierra system occur in schists, rhyolites, and rhyolite breccias. Those of La Luz district occur in schists with a capping of granite, the fissures being comparatively barren in the granite.

The veins in the district are characterized by a peculiar form of ore deposit called *ramaléos*, consisting of brecciated wall rock laced together with stringers of quartz. The *ramaléo* often extends to a considerable distance from the ore. Between the Veta Madre and La Luz vein systems there are several smaller veins, especially near the hanging wall of the Veta Madre.

The Pinguico vein is one of the peculiar features of the district. This vein is capped by the andesite; the fissure extends into the capping andesite, but the ore did not appear in it until a depth of 250 ft. was reached below the contact of the andesite with the rhyolite inclosing the vein. The capping andesite is 680 ft. deep. This vein was discovered in 1903, being traced from the neighboring Carmen mine where the andesite capping has been eroded. The upper ore of the Pinguico vein consists of brecciated vein matter cemented with moist clay forming a pasty ore hard to mill. In depth this ore has become harder and more closely resembles the ore in the other mines. John A. Church suggests that this vein in the hanging wall of the Veta Madre has bled the southern portion of the Veta Madre as the Comstock vein did the Virginia vein at Virginia City, Nevada. The strike of the Pinguico vein is north 35 to 40 deg. west.

The Ore

The vein minerals are argentite, stephanite, pyrite and polybasite in a quartz gangue; galena, sphalerite and chalcopyrite also occur, but that rarely. Proustite is frequently found in La Luz mines. Native gold is sometimes found in some La Luz mines and in those of the Sierra system. The mine richest in gold in the Guanajuato district is the San Nicholas del Monte of the Sierra system. The quartz occurs amorphous and crystalline; frequently it is amethystine; calcite sometimes occurs in the ore in considerable quantity, especially at the Jesus Maria mine at La Luz, where in some parts of the mine there is more calcite than silica in the ore.



GUANAJUATO; THE VETA MADRE FOLLOWS THE ESCARPMENT BACK OF THE CITY

The ratio of gold to silver varies considerably in the different veins. In the Jesus Maria mine the ore at present mined is worth $6 per ton, 58 per cent. being in gold. In the Peregrina mine the ratio is 13 silver to 1 gold. At the Sirena mine the ore at present mined after 15 per cent. waste has been sorted out averages 13 oz. silver and 0.057 oz. gold per ton, or 228 parts silver to 1 part gold. In the Pinguico the ratio of silver to gold is 123 to 1.

Wages in the District

The wages paid in the district are: Helpers on piston drills per 10-hour shift, 2 pesos; hand drillers, 1.50; shovelers, 0.75; skipmen, 1.25; timbermen, 1.25; helpers, 0.75; trackmen, 1.50; helpers, 0.75; pipemen, 1.25; tool

[1]For full discussion of the geology of Guanajuato, see the JOURNAL, April 14 and 21, 1904; Nov. 24, 1906; July 20 and 27, 1907.

sharpeners on hand steel, 2.50; on machine steel, 3; helpers, 1.50; carmen, 1; motormen on electric locomotives, 1.75; conductors, 1.75; hoistmen, per 8-hour shift, 1.50 to 2 pesos. Peons on surface get 50 to 75 centavos. The machinemen on large machines work on contract and average about 3 pesos per day.

General Conclusions

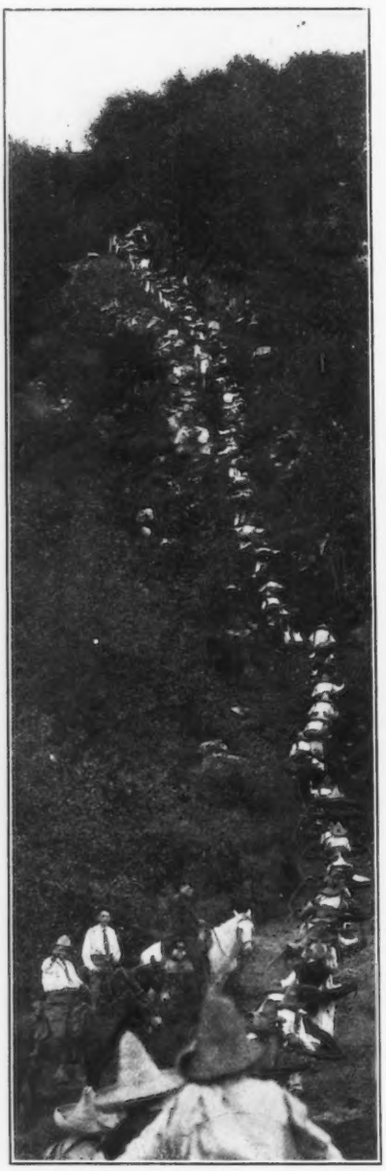
Guanajuato has had a great past; it has proved the success of cyaniding silver ores, and from being a decadent camp only five years ago it has become one of the foremost active silver camps in Mexico. Most of the ore treated since the revival has come from the dumps, but the mines are being unwatered and developed rapidly, and the tonnage coming from them is daily increasing. The great problem of the wet metallurgy of silver ores has been successfully solved and now it remains to improve the mining methods. Joseph MacDonald, formerly in charge of the Alaska-Treadwell mine in Alaska, is manager for the Guanajuato Consolidated Company, and Cortlandt E. Palmer has been directing the operations of the Guanajuato Development Company since April, 1908. Mr. Palmer has already reduced the cost of mining and has increased the tonnage mined at that company's properties by modernizing the mining methods. With the example of such men the mining methods of the other companies will be given the study that heretofore has been given to the metallurgy of the ores. The room for improvement lies more at the mines than at the mills.

Guanajuato has a good source of electric power at reasonable cost; the walls of the veins are strong so that little timber is required in mining the ore; water is plentiful for milling, if not over-abundant, and fortunately, the mines along the Veta Madre and other veins do not drain each other; labor is plentiful and of a good quality, except in regard to its ability with the hammer. But the more extended use of air-hammer drills will solve this weakness in the labor, and render it possible to use ore-filled stopes in mining, for that method seems to be the one best adapted to mining the large orebodies of the district.

The forming-up of 1⅛-in. octagonal steel into a 2½-in. star bit is condemned by W. E. Kimber (*Journ.* Transvaal Inst. Mech. Eng., May, 1908). He states that this staving-up does not improve the steel and, further, that it is expensive. Instead, he recommends the use of cheap steel for the shank and a piece of good cruciform steel, 9 in. long, welded on for the bit. The saving in the cost of the cheap steel almost pays for the welding. As the steel when it becomes too short for starters (2 ft. long) must be welded, he thinks that it is as well to do the welding first as last.

Packing 13,000 Feet of Steel Cable Over a Mountain Trail

The long file of peons shown in the accompanying illustration is a section of the procession of 350 men who packed 13,000 ft. of steel cable from a point on the Inter-oceanic railroad, a distance of 5½ kilometers over a mountain trail to the Chignautla limestone quarry of the Teziutlan Copper Company in Mexico at a cost of $90. Although in the photograph the men, each bearing a coil of the cable, appear to be deployed along a fairly steep ascent, the trail selected by Cyrus Robinson, the engineer in charge, was practically level. The quarry, the upper terminal of the tramway for which the cable is to be used, lies immediately beyond the ridge which the men seem to be climbing.



PEONS CARRYING STEEL CABLE

The country in that part of Mexico is far from level and the trail necessarily had several curves and difficult twists where a dozen or more men might easily have been swept into the arroyo had the speed of the different parts of the long file not been carefully regulated. To prevent mishaps of this kind and also to avoid injury to the cable, the men were carefully organized before the march began. The peons were taught to preserve their proper distance and each ten men were under command of a *cabo*. A single pistol shot was the signal for starting and two shots ordered a stop. The entire operation was completed without the slightest mishap.

The tramway, of which this cable forms a part will deliver limestone from the quarry into the bins of the new smelting works now in process of construction at Teziutlan. The upper terminal is at an altitude of 7800 ft. and the smelter bins have an elevation of 5200 ft.; 1800 ft. of this drop occurs in the upper 4000 ft. of the line. Owing to the steep inclination (30 deg. at the upper end) no friction grips can be used; only solid grips are to be employed.

The tramway is a Leschen automatic and has a capacity of 20 tons per hour. There are 34 all-steel towers and the longest span is 1500 ft. The towers are mounted upon concrete foundations, and the steel will be protected from the weather by a coat of asphalt paint. One man will be detailed to devote his entire time to inspecting and painting these towers. When he has finished painting at one end of the line he will begin at the other and continue indefinitely.

Rhodesian Production

Gold production in July was 54,237 oz. fine; the largest monthly output ever reported. For the seven months ended July 31, the total was 351,545 oz. fine gold, or $7,266,435. The total reported for the seven months in 1907, was 346,046 oz.; but no comparison can be made, as the returns last year were made in bullion, and this year in fine gold.

Other production reported in July was: 28,151 oz. silver; 115 tons lead; 8 tons copper; 617 tons chrome ore; 5 tons asbestos. This is the first time asbestos has appeared in the returns. Coal mined was 9158 tons.

According to Consul-General Michael, of Calcutta, the output of amber in 1907 by the mines of Burma was 2½ tons, valued at $1920. These mines are situated in the administered territory of the Myitkyina. The output of the year previous was 216½ cwt., valued at $3543. Amber mining in Burma is reported not to be a paying business. The average value of amber in Burma is $43 per cwt., which is higher by $8 or $9 than the price of last year.

South Staffordshire Method of Mining Coal

Circular Brick-lined Shafts with Rope Guides Are in Common Use, and One Hoisting Engine Drum Sometimes Serves Two Shafts

BY LUCIUS W. MAYER*

Typical operation of the South Staffordshire method of working a thick coal seam was first observed at the Sandwell Park colliery. This mine is located in the heart of the South Staffordshire district, the county of Staffordshire, known as "Staffs." The nearest town to the colliery is Smethwick, which is on the northeastern road from Birmingham, some 10 miles distant.

Birmingham is the fourth largest city in England and is located in the northwest corner of Warwickshire. It is known for its eminence as a manufacturing town for the production of all kinds of iron, brass, and metallic wares; coming after Manchester in importance as an industrial center. Passing from Birmingham to the northwest, there is a succession of iron manufacturing towns, and coal mines are seen continuously along the route, which shortly passes into Staffordshire county. The district is locally called the "black country," but the atmosphere and surroundings hardly bear out the fairness of this name.

Some of the largest coal plants in the country are located in this vicinity, and recent new discoveries of extensive coal beds have brought in capital for the erection of high-class plants, typical of the English policy in regard to permanency. The coal bed in this district is generally known as the 10-yd. seam, though this thickness is not general. At the Sandwell colliery, for example, the average thickness approaches 14 feet.

To summarize the method of mining in a general way, it may be stated that roads are usually driven out to the boundary, and the operation of mining is accomplished on the retreat on a series of blocks of coal, which are separated one from the other by ribs or narrow pillars of coal. Within these ribs, small, square pillars are left for the support of the roof. The first work is done in the bottom 6 ft. of coal, and the top coal is won by cutting what are known as spurs into the roof between the pillars; in this way the coal is brought down slice by slice with the assistance of light powder shots. This method is also used in certain parts of India, whence a number of South Staffordshire workmen have gone. There the roof and floor are of a hard sandstone.

The Sandwell Park Colliery

At Sandwell Park, they have 10 ft. of material called "bind," which lies over the coal. Above this bind are successive layers of red and gray sandstones with intervening coal seams and shales. Eighty yards from the surface is an unworked seam 3½ ft. thick, called "brooch," which has exceptional qualities for household purposes, and seems to bear similar characteristics to the comb coal at Watnall colliery.

The main coal is worked to a depth of approximately 1260 ft. at Sandwell. This is not a maximum for the district, where some very speedy hoists have been erected by the Allis-Frazers Company for lifts up to 2000 feet.

A general view of the Sandwell Park colliery is shown in Fig. 1. In this illustration, notice that cultivation does not seem to have suffered much as a result of the subsidence. The three pits, headframes of which are seen in the figure, are about 200 ft. from one another. Two of the shafts serve as downcasts. All three pits are circular and are brick lined throughout. The center head-frame is of steel design, being of latticed girders. It is 60 ft. high from base to sheave wheel shaft, 28 ft. center to center of legs, and 52 ft. from center of back-stay to near upright leg.

Rope guides are suspended in one of the shafts. Only three of the ropes are used for guides in each compartment, two on one side, and one in the center of the other side. These ropes are 1½-in. in diameter, and of single-wire strands. The ropes, which are weighted at the bottom of the shaft, are free to meet the changes of length induced by variance in temperatures. Within 15 ft. of the collar of the shaft, timber guides are placed which insure steady landing of the cage. Aside from the guide ropes on which the two cages run, the shaft is clear below the shoes above mentioned.

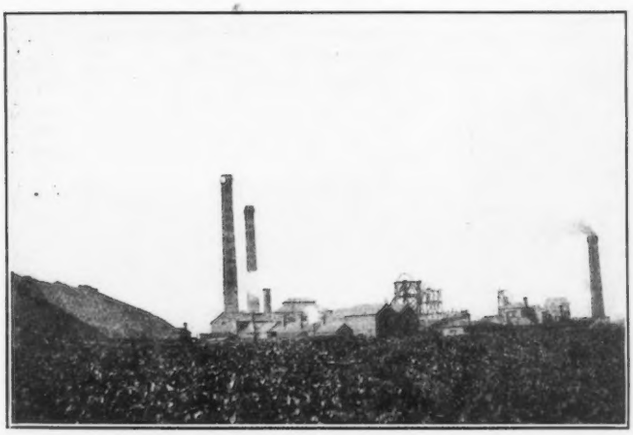


FIG. 1. GENERAL VIEW OF SANDWELL PARK COLLIERY

FIG. 2. EXTRACTION OF COAL IN FORMING THE PILLARS

Weights are not always used for keeping the ropes taut. In a deep shaft, as much as 7 or 8 tons may be required to properly stretch and hold the rope. This involves more or less space, which may be ill-afforded where sump room is limited. A number of mechanical devices have been employed for holding the rope in place. It is, of course, extremely desirable that the ropes be held perfectly taut, and they should not twist. Accidents due to cages coming in contact with each other in the shaft during the flight are not unheard of. The cage is a double-decker, each deck holding two cars end to end.

Catching Water in Shafts

The matter of dripping of water in the

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shafts has received careful attention in the South Staffordshire district. Water rings, or what are called "garlands," are set at intervals in the shaft. These act as receptacles for the water, which is conducted down the shaft from these reservoirs in small pipes, to join the body of mine water to be pumped.

There are a number of forms of water rings which are set to encircle the inner part of the shaft lining. The common form is simply a groove-like depression in an iron casting, which is set in the brick lining of the shaft. Above this the bricks are trimmed inward, so that the water in running down the lining is conducted to the groove, from whence it drains to a common point where a tube connects, and the water which has found its way into the groove is conducted down the shaft. This form, however, has not proved so desirable because of the accumulation of small particles of refuse necessitating a frequent cleaning out.

Another form of water ring often seen in the Staffordshire district appears to serve the purpose well. In sinking a circular shaft in moderately hard formation, what is known as a "curb" is placed at certain intervals in the course of the sinking work. This curb is simply an annulus which may be of timber or metal, and is divided into a number of segments which are fastened together to complete the circle. Timber laggings are fixed behind these curbs, which perform practically the same duties in circular shafts as regards holding the lagging in place as our square shaft sets do in America. It may be stated here that the square shafts are as rare in Europe as circular shafts are in America.

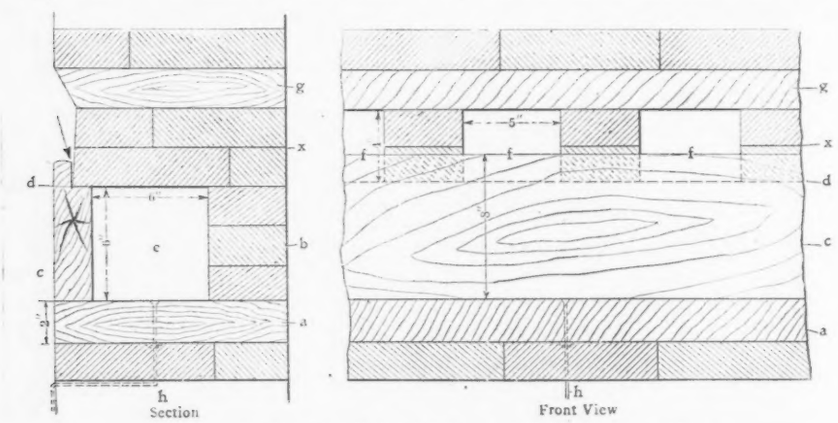

FIG. 3. GENERAL DETAILED METHOD OF CONSTRUCTING A CURB

The Construction of a Curb

Vertical stringers are placed between the curbs to act the same as our hangers. In setting these water accumulators, an ordinary curb is set in the usual manner, see Fig. 3. Two or three courses of brick are now set on the curb back as shown at *b*. A wooden piece *c*, made of flexible plank about 2x8 in. and having a ledge *d* cut on the top, is now set on end and nailed to the curb *a*. This is so arranged that the outer edge of lip *d* is flushed with the inner line of shaft.

Resting on this ledge *d*, and on the bricks *b* is set a series of bricks *x*. Thus an archway *e* is formed, in which space the water accumulates. These latter rows *x* are placed at intervals, leaving a space of 4 or 5 in., as shown by *f*, in Fig. 3. In this way the water coming down the shafts finds its way into the reservoir *e*. Above the rows *x* a second curb is placed; *d*, the top edge of which makes the original width to the lining, and the shaft from that point on, is again of the original inner diameter.

At *h* is shown the pipe, which is simply a small pipe for conducting the water from the reservoir down the shaft, either to the next garland, or else, if it is the last reservoir, to the sump. Behind the brickwork, ashes or puddled clay is packed, and all joints between the curb and the brickwork are made tight.

Steel Timbering at Sandwell

The prevalent use of steel underground was noticed, but as elsewhere, the use of this same material is more for girders than for any other purpose. It is generally used in England, usually to replace the timber caps only, wooden posts being retained.

Where heavy pressures have to be counteracted, the use of steel girders has proved economical; instances have been noted where timbers have had to be changed two or three times, within short intervals. The first cost of steel is, of course, much greater, but under certain conditions the final cost has been found to be less.

At Sandwell, steel is used considerably in the stations, and also on main haulageways. Where a side pressure is met, a shoe is shrunk on the beam at the point where the beam rests on the edge of the post. This shoe fits around the lower flange of the girder and butts up against the post. The girder often used weighs about 66 lb. per yard, and has a 4 to 5 in. web and flange. A one-half inch thickness of metal is used for an 8-in. span.

Controller Device

A device has been installed whereby the engineer on a haulage motor is restrained from throwing the controller at full speed in a sudden manner. On a motor controlling the haulage on an incline, the controller wheel was engaged with a thread gear so pitched that the movement of this screw effected only a gradual throwing out, or in, of the resistance. It was impossible for the engineer to move his controller with sufficient speed to cause a burning out of the motor. It was so arranged, however, that while the engineer could only throw out the resistance in a gradual manner, he could throw it on in its entirety at any moment, should a sudden stop be necessitated. In this way common labor could be employed at these stations, where formerly a more or less intelligent class was required.

It may be remembered that one of the chief features of the South Staffordshire mines to be reckoned with, is the gas, which rapidly accumulates in this formation. On this account, more than any other, perhaps, is due the system of mining whereby these rectangular sides of work are shut off one from the other in the progress of the work.

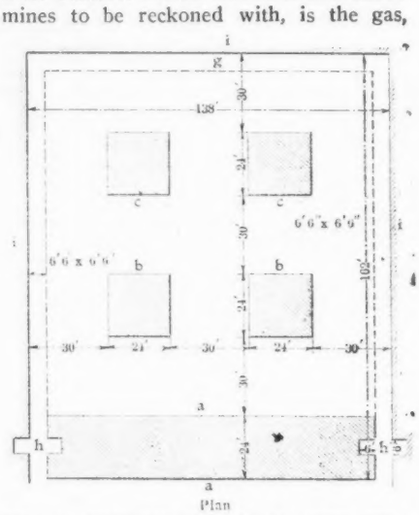

FIG. 4. SHOWING COAL SEAM AFTER FIRST STAGE HAS BEEN COMPLETED

In working the South Staffordshire beds there are three distinct stages of operation. The first is the getting of the coal in the manner previously described. The second is the winning of the coal in pillars and ribs, and the third is the recovery of coal left in the second stage. In the third stage, the work is carried on entirely through broken ground.

Many years may elapse between the operation of these various stages. The third stage, for example, may be an attack on a mine which has not been operated for 50 years, and where coal hitherto not of sufficient value, may now be extracted with profit.

That the South Staffordshire system of mining involves danger is beyond question. The number of accidents due to

falls of roof is very large. The system requires a great amount of skill, and could not be successfully operated by miners acquainted only with the ordinary methods of mining coal. In this section the men have grown up with the system, and in spite of this, only the ablest men are employed in getting down the roof coal.

Handling 30-foot Timbers

In a 30-ft. seam, about 24 ft. of coal will be brought down by dropping. Timbers sufficiently high to hold up this roof in working places, must naturally be employed, and the handling of timbers of 30 ft. hight in an expeditious manner is an art in itself.

There is no better evidence of the fulfilment of the duties of these timbers than seeing the roof fall as soon as they are removed. Fig. 4 shows a side of work, the first stage having been completed. The original roads are outlined by the dotted lines *i i i*, and are the ribs which encircle this work. Fig. 5 shows the pillars being formed and work of extraction in the intervals. The section on Fig. 5 shows the completed side of work before withdrawal of all timbers. Fig. 2 shows a similar condition as exists in the plan illustrated by Fig. 5.

The white cross to the left of the man's head in Fig. 2 shows the corner of a pillar, similarly as at *X*, in Fig. 6. Note the timbers supporting the upper coal. The photo was taken at a point shown at *f*, Fig. 6, where there was 20 ft. of space overhead, the roof having begun to destroy itself, following removal of timbers. In Fig. 2, above the white cross *X*, a spurn would be holed, and on removal of the timber seen in the illustration, a considerable amount of coal would be brought down with the aid of light shots.

Measures Anticipating Fire

To meet the constant exigencies of impending fire, sides of work are so arranged that they may be cut off at any time. As soon as fire breaks out, this particular side of work is abandoned, and cribs of timber are set in the places *h*, of Figs. 4 and 5. This cribbing is filled with bags of sand, and the district is shut off and placed out of communication with the circulating mine air currents. These pits are quite hot and dry. The men drink a peculiar kind of beer, which is brought to them at intervals. As shown in Fig. 2, the men often work stripped from the waist, but do not seem to suffer from the unusually warm conditions.

In gathering the coal to be loaded into the cars, shallow baskets are commonly used in this district. They are made of wicker work, or some light metal. Coal is raked into the basket by means of a short-handled wide-toothed rake, or with a scoop. It is claimed that with these baskets a man loads considerably more than he could with a shovel, especially where the floor is even. Certain it is that he makes fewer movements from the floor to the top of the car by this method, inasmuch as the baskets hold several shovelfuls.

Delph Colliery

With a view of investigating the second working of the South Staffordshire coal, the Delph colliery was visited. This is in the same district as Sandwell Park, near a place called Breattle Lane, on the Northwestern line.

In reviewing the first stage of work of the South Staffordshire method, the pillars are supposedly standing, but the roof between the pillars has now a tendency to fall, as practically all the timbers have been removed. The pillars are not necessarily the original size as cut in the first work, because very often an attempt is

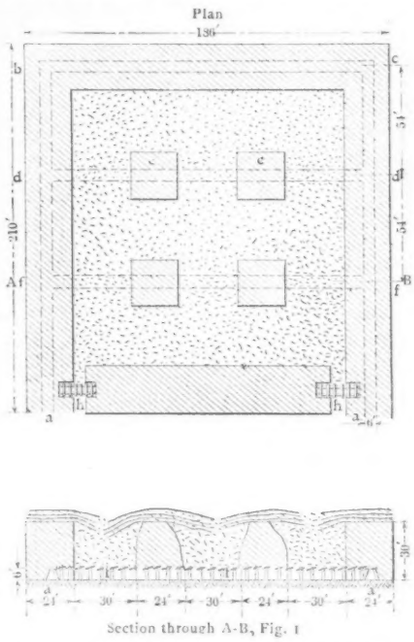

FIG. 5. SHOWING COMPLETED SIDE OF WORK BEFORE WITHDRAWAL OF ALL TIMBERS

made to remove the pillars during this first work, though a complete removal is rarely effected. The ribs of coal would not be touched in the first working. Finally a condition of thoroughly packed areas exists around the pillars, as shown in Fig. 5. In the course of time this material solidifies to such an extent that the work of passing through it presents quite the same conditions as the original coal did, though this extreme condition does not obtain until the ground has been allowed to rest for a long time. It may be 20 or more years between the time of first working and second working. Nearly all the timber is removed in the first working.

To regain the ribs and pillars, roads 6½x6½ ft. are driven through the ribs, which latter are 24 to 30 ft. wide. When the back rib is met, roads are started and driven in this back rib until they meet. Then working on the retreat, the operation of taking the rib is carried on. In the meantime, from the side ribs, roads are driven through the fallen ground to cut the point where it is known that the pillars or stumps are standing, though perhaps in more or less shattered condition.

The work of taking the rib of a pillar is then carried back. Pillars are removed in the ordinary way by undercutting, setting up posts, and finally, intelligent removal of the posts with ensuing fall of the coal from the upper part of the pillars.

The Seam Was Mined 100 Years Ago

In the Delph mine, coal was being mined 100 years ago, but then only the best of it was taken, so that now the work is largely the recovery of coal not marketable in those days, which at the present brings in a profit. At a lower level in the same property, clay is being mined, and is used for burning into bricks.

The coal seam is far from clean; there are innumerable bands of shale, etc., each of which is recognized by the natives and given a name. Where a band of stone becomes thick, the method of getting the coal is to first mine out under the stone band, support this roof with timber, and withdraw this timber after the coal in an area has been removed from under; now dropping this stone and standing on the fallen ground to attack the coal above.

The Top Fence

A very neat form of top fence is used. This is formed of two upright stepped posts, on which rest four boards. First, the longest board rests on the top of the posts; second, the next shorter rests on its step, etc. The vertical movement of these boards is governed by the light rope guide, which passes through holes at each end of the boards.

Parkhead Colliery

In the third stage of the South Staffordshire method of mining, the major part of the coal seam is practically drawn. The pillars have been removed as far as possible in the first and second stages, but there is considerable pay material left to be mined by the man who is after a moderate profit with reasonable outlay. The Parkhead colliery is located at Brierly Hill, a few miles from the seat of the Delph operations.

At this mine, the shafts are uncommonly close together. One hoisting-engine drum serves both shafts, the balance being effective between the two cages. The purpose for having the drum outside in the hoist house appears to be to simplify construction, and economize on building material, as in this way a small engine house is required. It is not infrequent in South Staffordshire to see two shafts several hundred feet apart operated by one

engine, which may be placed midway between the two shafts, the hoisting ropes being held in position at intervals by light timber frames and idler pulleys.

Underground Conditions

Conditions existing underground are a completely fallen roof, with roof coal in the goaf, also stumps of pillars and ribs. The drivages are entirely in loose ground.

A heading 6½x6½ ft. has been driven out to the limits of the property, and a small air course 4x4 ft. runs parallel to it. From these courses branch courses radiate, and the work is brought back each time to the main heading. Every 12 to 15 yd. a ventilating cross-heading is run. The branches are made only about 20 yd. long, and when all the ground is exploited, which has been blocked out in this manner by branch headings, another set of main headings are driven to the boundary, similar to the first, and the operation of driving branch headings from this main heading repeated, as well as the winning of the coal in this new area, until finally all the ground is worked out. Control of air circulation is quite difficult with means at hand, and in this case was extremely poor. The returns from this kind of work are not prodigious. The work is usually carried on by leasers, who, as a class, are not prone to elaborate outlay.

The air current in this particular mine is stimulated by the dropping of water down one shaft, a jet of steam being passed up the other. Ventilation is at its best very poor, and the presence of black damp was so noticeable during my visit that it was only with great difficulty that illumination could be maintained; certain working places could not be entered on this day. In driving through the loose ground, forespiling is resorted to.

Colliery Notes

A squeeze may sometimes be stopped by flushing the affected area with culm.

Leaving exposed places on an electric mine cable in order to make connections is a dangerous and objectionable practice.

When suspicious of the condition of a section of roof, examine the timber caps, as their condition is one of the best indications of roof disturbance.

Steel wire used in the manufacture of the best qualities of winding ropes has a breaking strength of from 100 to 120 tons per square inch of sectional area.

Twisted drills are recommended for putting down blasting holes, as the uneven surface left by these drills is an efficient aid in holding the stemming in place.

It is stated that silica bricks for use in the flue walls of coke ovens give better results than do the quartzite bricks generally used. Silica has the advantage of not being injured by the high heat required, and is also a better heat conductor than is quartzite.

Cage keeps tend to shorten the life of a rope, and occasion jerky strains. Tests carried on under working conditions have shown that with less than one foot of slack chain, the strain on the rope in picking up may sometimes be as much as three times the actual load.

When recapping a rope, which should be done three or four times a year, a length of rope not less than one-half of the circumference of the head-gear pulleys should be cut off with the old capping so that the excessive wear to which the rope is subjected may not become local.

Where low-pressure motors are used, shocks from live wires intentionally left exposed are comparatively frequent in consequence of the exaggerated idea of the harmless nature of the shocks produced by them. The practice of leaving these wires exposed is nevertheless a grave source of danger. They should be as carefully protected as the wires of high-pressure motors.

One of the safety cage devices favorably reported upon by the Transvaal commission is a device consisting of a steel cylinder containing liquefied carbonic-acid gas, which, in the event of the rope breaking, operates two rams or pistons working in other cylinders. These rams are designed to actuate brake-blocks which bear upon the rigid guides in the shaft and bring the cage to rest gradually.

In England, from 75 to 80 per cent. of the deaths resulting from colliery explosions have been found to be directly due to carbonic-oxide poisoning. The use of excessive quantities of explosives in poorly ventilated rooms often results in headache, listlessness, etc., in the miner, which is the result of a partial poisoning. Many explosives, particularly common blasting powder, produce a large amount of gas when fired; 40 per cent. of this gas is carbon monoxide.

Jerky winding with its sudden variations of strain on a rope, is due either to unskilful manipulation, to a wrongly proportioned engine, or to unsuitable controlling appliances on the engine. Even a skilful engineer cannot avoid jerking if the engine is wrongly proportioned. If it is not so proportioned that either cylinder can start the load with a reasonable rate of acceleration, there is a temptation to start with a run or jerk so as to overcome the dead center.

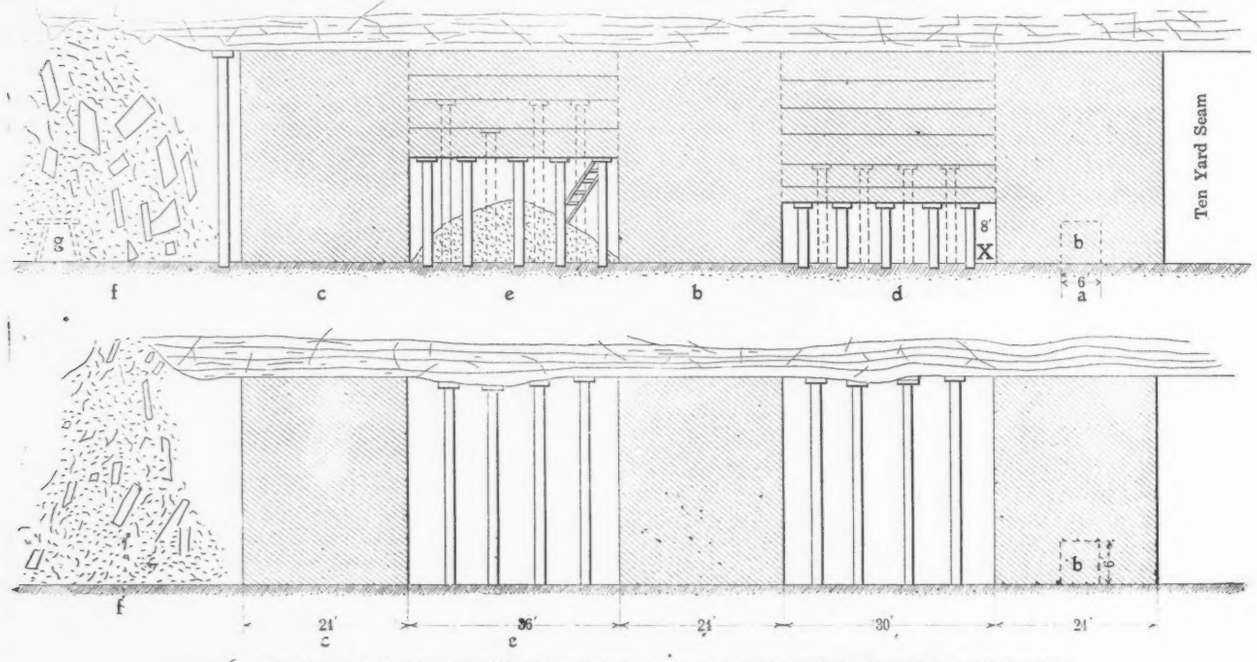

FIG. 6. TWO STAGES IN THE METHOD OF DROPPING COAL BY THE SOUTH STAFFORDSHIRE SYSTEM

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The Proposed Mexican Mining Law

No question has been more earnestly debated in Mexico this year than the new mining law proposed by Señor Molina, the Secretary of Fomento, and there never was a more enlightening debate, serving to bring the pros and cons upon common ground. It has developed that the intention and effect of the proposed law are by no means so unjust to foreign corporations as was originally interpreted, being indeed only of the character that other self-respecting countries have enacted without protest. This is ably pointed out by several correspondents in this issue. Even the opposition of the influential *Mexican Herald* has ceased. On the other hand, the Government of Mexico has all along accepted the criticisms in an admirable spirit. It has sought by argument and logic to convince its opponents of the merits of its position and to a large extent has succeeded in so doing. At the same time it has given serious consideration to the sound objections that have been raised against the proposal and has signified its intention of so modifying the law that it will contain nothing inimical to foreign capital already invested in Mexico, or seeking investment there. This is a happy ending of what began as a bitter controversy and confirms the belief, that we have often expressed, in the fairness and consideration of the administration of President Diaz.

Mining in Mexico

The range of mining in Mexico is well illustrated by the articles in the present issue of the JOURNAL. The historical and general industrial features are engagingly and illuminatingly treated by Mr. Smith and Mr. Tays. Modern mining is described by Mr. Russell and Mr. Rice, who write of two of the great camps—Nacozari and Guanajuato—one noted for its production of copper, the other for its silver-gold ore. It is a vast range in the scale of progress from the old workings described by Mr. Tays, from which the ore was laboriously raised by *tanateros* and *malacates* to the electric trains running into the great electrically lighted adit of the Pilares mine, described by Mr. Russell. Even in the short recollection of engineers of middle age, who first knew Mexico 20 years ago, it is still a source of amazement that so many features of modern engineering have been introduced in Mexico in so brief a time. Those who painfully made their way by *diligencia* and muleback to some remote camp in the Sierra Madre to labor at mining and metallurgy with a combination of primitive methods and modern makeshifts find it difficult to realize how such places as Monterey and Cananea have come into existence.

So it is with metallurgical progress, particularly in the extraction of gold and silver. Bartolome de Medina invented the patio process at Pachuca in 1557 and for more than three centuries it remained the chief means for working silver ores. It was not until 1793 that mules and horses were first used for mixing the pulp, mercury and chemicals, which previously was done by human labor alone. This improvement saved 75 per cent. in the cost of the process. In the latter half of the nineteenth century pan-amalgamation was introduced; then hyposulphite lixiviation; finally the cyanide process. In the application of the last to the treatment of silver ore Mexico has led the way. Such methods as are in use at Pachuca, which Mr. Rice describes, are a revelation of the wonderful metallurgical progress in Mexico. Mr. Lamb's interesting description of an old *hacienda* at Guanajuato is a striking antithesis. It is one of the great charms of Mexico that it has such a romantic, historical background.

The Ely Companies

According to an evidently inspired report in one of the newspapers, an effort is again to be made to consolidate the Cumberland-Ely and the Nevada Consolidated companies. It is said that stockholders of these companies have been led to expect a consolidation of them for over two years, as if this were something greatly desired by the stockholders, especially the minority stockholders, who will not be satisfied until they secure it. This is humorous, inasmuch as the proposed consolidation has all along been blocked by large minority interests in the Nevada Consolidated, which have been unwilling to agree to an amalgamation of the two companies upon any basis other than an unbiased intrinsic valuation of each, which in their opinion is something widely different from the valuation current in the stock markets.

The previous jugglery whereby the

Nevada Consolidated gave up to the Cumberland-Ely a half interest in the Nevada Northern Railway, and allowed the Cumberland-Ely to join it as an equal partner in the construction of the Steptoe reduction works for various considerations, among which was 200,000 shares of Cumberland-Ely, valued at $10 per share, was an operation that did not reflect credit upon the Guggenheims in their relation toward the public. As things turned out, the arrangement did not prove so bad, perhaps, as it really was when consummated, and anyway the stockholders of the Nevada Consolidated have been resigned with the idea that the worst had happened.

Now it is said that the properties could be more economically managed under one head, and that the joint ownership of the railroad and smelter has already resulted in more or less friction. It is complained also that developments by the Nevada Consolidated have been conducted aggressively, whereas the reverse has been the case with the Cumberland-Ely company. The Nevada Consolidated is said to be now planning an increase in the Steptoe plant and the purchase of additional stock in the Steptoe company, so that it will have a majority interest in that company. This cannot fail to be amusing to large interests which have grumbled under the Guggenheim management. The stock of the Nevada Consolidated company has been widely distributed, and the interests of its owners must be carefully guarded if the Guggenheims are to preserve some of the esteem among investors that they once had so richly. It is only fair to say that the rumor as to plans for the consolidation of these companies was promptly denied by the Guggenheims.

Freight Rates on Anthracite and Bituminous Coal

From time to time there has been much discussion over the railroad rates charged on anthracite coal from the mines, and comparisons have been made with those on bituminous coal. The question is brought up again by the simultaneous publication of the annual reports of two great coal-carrying roads, the Philadelphia & Reading and the Chesapeake & Ohio. With both these roads coal constitutes about two-thirds of the business; but the coal carried by the Chesapeake & Ohio is wholly bituminous, while the Reading's tonnage is chiefly anthracite. A comparison of data from these reports will, therefore, be of interest. Both cover the same periods, their fiscal years ending June 30 last.

The data given in the Reading report are not as explicit as they might be. The coal rate is not separated from that on general freight. The average rate on all freight carried was 0.954c. per ton-mile. This was probably a little above the coal rate, though there is no way of determining exactly. A closer approximation can, however, be obtained from the statement of the Philadelphia & Reading Coal and Iron Company, which furnishes the bulk of the anthracite carried by the railroad. That company paid out for railroad transportation on its coal an average of 83.6c. per ton. Taking the average haul from Reading mine points to tidewater and leading consuming points, this gives an average rate of over 0.8c. per ton-mile. The true average on all anthracite hauled would be somewhere between the 0.8 and 0.954c., or perhaps about 0.85c. per ton-mile.

The Chesapeake & Ohio report goes more into details, and gives the average rate on all coal hauled at 0.326c. per ton-mile. The very low rate is imposed by the conditions of competition. New River and Kanawha coal has to be hauled from 350 to 400 miles to tidewater. It must compete there, not only with Pocahontas—which has about the same haul—but also with Cumberland, Clearfield and other coals, which are carried only about one-third the distance to tidewater and Eastern markets. Moreover, there is nearly as long a haul on the Chesapeake & Ohio coal to Western markets, where it must compete with that of Ohio, Indiana and Illinois mines. Low as the present rate is, it is 30 per cent. higher than that charged a few years ago, when Pocahontas and New River coals were hauled to tidewater on a rate of 0.25c. per ton-mile.

It is true that the proportion of terminal expenses is higher on a short than on a long haul. On the other hand, anthracite stands handling far better than bituminous coal, and can be unloaded and transferred more cheaply. The fact remains that the rate per ton-mile on anthracite to the seaboard is more than two and one-half times that on bituminous. The reason, of course, is that bituminous coal is sold under competitive conditions, while in the present position of the anthracite trade there is practically no competition. Long ago a high authority said that the profit on anthracite had never been in mining, but in carrying and selling it. The reports of the railroads and coal companies show that this is as true today as it was then.

The Use of Privately Owned Coal Cars

The decision of the United States Circuit Court of Appeals in the Pitcairn Coal Company discrimination case—given in our last issue—does not, as some newspaper comments seem to indicate, interfere with the use of coal cars owned by companies and individual shippers. In effect it only provides that discrimination in favor of operators owning such cars is unlawful; and that, in distributing cars to coal mines, the total number of available cars must be taken—no matter whether they are owned by railroad companies or coal operators—and the allotment must be made to each mine of its proportion of the total number, calculated on an equitable basis.

This rule does not interfere with the use of cars owned by coal companies. It does, however, deprive the owners of such cars of the advantages which they have heretofore had on various roads through the return of their own cars. At a time when cars are scarce, this might increase their shipping facilities largely, to the disadvantage of operators less favorably situated. Such a result the court holds to be in the nature of a discrimination contrary to the law.

THE MEETING OF the American Institute of Mining Engineers, which begins this week at Chattanooga promises to be well attended. The members who have gone to it will find much of interest in the important industrial region that is to be visited. At the same time a noteworthy list of technical papers is to be read. It is to be hoped that these will draw out a profitable discussion and that everything will contribute toward making this a red-letter meeting of the Institute, like some of those of old times.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Mexico's Proposed Mining Law

The term "anti-foreign mining law" has been widely applied in the press of the United States and Europe to the draft of a proposed revision of the Mexican mining law submitted by the Minister of the Interior, to the public, and to various commercial, industrial and progressive organizations through the Chief Executive for comment, revision, amendment, or veto, before placing it in the hands of the legislators or law makers of the republic, necessary to make it effective.

Why should the law as submitted be passed? If passed, what would be its effect on existing and future mine investments? These are questions of greatest interest to both local and foreign capitalists and investors.

The present investor is in no way affected. The constitution of Mexico specifically prohibits retroactive law.

Border States

The first section of the proposed law prohibiting foreigners from locating property in the "border States," Chihuahua and Sonora on the north, and Chiapas, Yucatan and others on the south, is only a mild modification of the mining law of the United States (which absolutely prohibits any foreigner making a mineral location until he becomes a *bona-fide* naturalized citizen) and provides a simple means by which any foreigner may acquire mining properties, that is, by presenting the Chief Executive with a petition properly indorsed as to good character, and asking a permit to acquire the desired property, which is in every event granted.

The reason for the enactment of such a law is self-evident. Along the border States the outlaw and criminal element—of which there are large numbers infesting these States, and who have emigrated from the United States and other countries—find mining a respectable excuse for their presence in the country, and while they are ostensibly mining as a vocation, they are in reality leading a "coyote" existence, carrying on a nefarious traffic, and are a disturbing element to both republics.

The instigation of raids across the border, the formation of revolutionary parties, a general disturbing of the peace of the country, is an all too common occurrence, and in every known case this border element, if not being the head of such disturbances, has been prominently connected therewith, and when apprehended its members appeal to the representatives of other governments as much abused subjects.

The passage of the proposed law would not only, to a great extent, do away with this disturbing and worthless element, but would enhance the standing of foreign mine-owners among strangers, the possession of the required certificate of good character, approved by the Executive of the Republic, going far toward establishing the respectability of its holder.

This section of the proposed law is fair and just in all of its purposes and proposed regulation of existing abuses.

Foreign Corporations

The second section of the proposed law, prohibiting unregistered foreign corporations from acquiring properties has so many sustaining arguments that space forbids enumerating more than a small portion, and the opposing arguments are positively nil.

Comparing with the corporation laws of the United States, we find that no foreign corporation can transact corporate business in any State in the Union until it has been duly registered or "naturalized." A "foreign corporation" is legally defined as a corporation organized in any other State, or in a foreign country.

In Mexico a corporation is organized under the Federal law with equal authority in all of the States of the Republic, while the corporations organized in foreign countries are legalized ("naturalized") by "protocolization" of the articles of incorporation and by-laws, subjecting themselves to the laws of the Republic, and paying the usual corporation fee.

Over-capitalization is the parent of fraud in all corporations, and in mining a tangible excuse is presented by unscrupulous promoters to the uninformed investor, by which this fraud is shown as a virtue.

One example will suffice: A company organized in the United States, sensationally operating in the state of Chihuahua, controlling by its various machinations the press, and capitalized for many millions of dollars, has sold millions of dollars worth of beautifully engraved paper to the public through the brokers of New York, and other stock markets of the United States and Europe, and through accredited agents in every small hamlet of the country where there was a chance to inveigle the unwary. The proceeds of these sales have been thrown to the sunlight that the reflected splendor might so blind the eyes of the more conservative investors as to induce them to part from their money and load themselves up with finely engraved stock certificates.

This company has paid dividends from the funds of its promoters derived from the sale of "private stock," and at the present time there are thousands of its former and present employees holding its worthless "paper scrip" while suffering for the bare necessities of life.

The poor stockholders who have, in many instances, invested all of their savings to buy the stock of this company at a fancy price, now find it quoted at but 1c. per share, and with no buyers at any price, while the great king promoter of this self-same company is traveling in state in the Orient. His great ranches and stock farms, wonderfully productive, are exempt from corporate debts.

More than 100 parallel cases of less magnitude might be cited of companies following the same course, and only deterred from like results by their lack of persuasive ability with the public.

Today the aggregate paper value of the mining stocks of over-capitalized and fraudulently organized companies who offer their shares for sale in the New York markets will far exceed $1,000,000,000, while the dividend, or that which will ever be dividend stock, will never be 0.1 per cent. of the enormous total.

The proposed new law practically prohibits such fraudulent capitalization, in that the organization or naturalization in Mexico of all companies operating or dealing in mines in the country a fee is charged, which, for a company with $10,000,000 capital would cost the organizers more than the entire assets of many of the numerous "wildcat" companies now in existence, while the costs for organizing a capitalization on the reasonable assets of the same mines' sales value would seldom exceed $250.

Fraudulent Holding Corporations

Another important reason in favor of the proposed new law, which, though technical, is all important, is, that it has been the custom for foreign companies to organize in the United States with "fraudulently" large capital, and then organize a subsidiary holding company of small capital in Mexico under Mexican laws. This subsidiary company acquires titles and transfers its stock to the parent company, which results in possession *de facto*, but not in title *de jure*, and under such

title the parent company does not, nor can it, have judicial recognition to protect their holdings in the Mexican courts.

At least nine-tenths of all the Mexican mine litigation arises from this double organization, the controversy between the foreign holders of the foreign company's stock, as to the possessory rights of Mexican titles, the suits being brought in the United States courts, thus reflecting upon the judiciary of Mexico, while tying up valuable industries that would under the Mexican laws be quickly and justly adjudicated without loss of time and at small expense.

As a further reason for the passage of the proposed law, the holding companies organized are capitalized at a very small per cent. of the parent company, solely to avoid the publication tax imposed by the Mexican law, which is the only tax placed upon corporate existence, so by this evasion the Mexican Republic is openly defrauded of just revenues, while the foreign corporation sports a capitalization from which it proposes to acquire millions.

The passage of the law as proposed would be a protective enactment for all legitimate mine operators, and a fatal blow to the corporation "high-grader."

S. L. PEARCE.

Alamos, Sonora, Mex., Sept. 9, 1908.

The Proposed Mexican Mining Law

In recent issues of the JOURNAL I find a number of articles sent in by correspondents in Mexico, giving a distorted interpretation to the proposed new mining law presented to the legislative bodies by the Ministerio de Fomento and criticizing it severely. It would be greatly appreciated by myself as well as many other Mexicans if you would publish extracts, or all, of the articles which I inclose, so as to show the injustice of these attacks and also to prove once more the impartiality with which your valued JOURNAL treats matters of interest to the mining industry.

FAUSTINO ROEL.

Monterrey, Mex., Sept. 12, 1908.

[The article which Señor Roel inclosed was a statement by Señor O. Molina, secretario de Fomento, in which arguments in defense of the proposed measure are presented. Substantially the same statements were published in the JOURNAL of June 20, 1908. If our correspondent will examine our columns carefully he will find both sides of this important question treated with the entire partiality for which he gives us credit. Our columns have been open to everyone who has had anything of importance to say for or against this famous measure, and our attitude is fairly summed up in the following sentences from a recent editorial in these columns: "As we have previously expressed ourselves, and as our correspondent reiterates in this issue, President Diaz 'has always treated capital with great consideration and fairness, and will in all probability continue to do so.' We feel that the present case may safely be left in his hands." —EDITOR.]

The Copper River District, Alaska

In his article entitled, "The Copper River District, Alaska," by H. A. Keller, published in the JOURNAL of June 27, there is a statement to which I think I may take exception. The article states that, "the ore on Elliott creek occurs in the amygdaloid *directly* below the Chitistone limestone." As a matter of fact, in only one instance has ore been found directly below the limestone, i.e., at the contact, while the great bulk of ore is found (1) in a series of fissure veins varying in their strike but a few degrees from a north-south direction, while the contact runs approximately east-west; and (2) as replacements in the amygdaloid at distances varying from 100 to 400 ft. stratagraphically below the limestone.

B. WEBSTER.

Superintendent, Hubbard-Elliott Copper Mines Development Company, Elliott Creek, Alaska, Aug. 25, 1908.

Coal Mining in Southern Anthracite Field

Your article "Coal Mining in the Southern Anthracite Field" was read with a great deal of interest by me as it describes almost exactly, the conditions that exist at one of our collieries, the Melmont mine, located in the northern end of the Wilkison coalfield, Pierce county, Washington.

The only difference is that the seam or strata does not contain any gas, which makes the weight and pressure hard to explain. Quite often, fireclay in or near a seam of coal will swell and cause a condition similar to the one you have to contend with, but there is no fireclay in the seam in our case, or none in the surrounding measures. However, I have seen a new slope down 400 ft. in the solid coal, drive the sinkers from the face, and close tight for a distance of 75 ft., in a few hours breaking timber 18 to 20 in. in diameter.

On the gangway, as soon as the set is up a few hours, you can see it has taken the weight, and often in a few days, you can hear the timber cracking, due to the enormous pressure, and in a short time a collar or a leg 18 in. in diameter is broken and has to be replaced. Often the gangway will close when it is 500 ft. ahead of any working places, and a crosscut will close so tight that it is impossible to tell where it was originally driven.

The seam pitches 45 deg., has a sandrock floor, 11 ft. of coal, 3 ft. of slate cap-rock, and 200 ft. of sandrock to the next seam which works exactly in the same way. We are developing the seam on the chute, or stand-and-pillar system.

After watching the condition at this mine for several years, the only explanation I can offer is that the weight on the seams is due to the unstable condition of the superimposed strata, due to the pressure that caused the tilting of the seams and fractured the original bedding of the sandrock strata. This tilting was undoubtedly of a comparatively recent age, and is probably still under some tension. The coal seams in this district were laid down in the Tertiary Era.

The coal mines working this seam, within three miles on either side, do not have these conditions to contend with, their gangways will stand for years without retimbering, so the cause of this condition is local to the immediate territory of this mine.

GENERAL SUPERINTENDENT.

Northwestern Improvement Company.

Roslyn, Wash., Sept. 10, 1908.

The Goldfield Consolidated Mill

In my article on the Goldfield Consolidated mill, which appeared in the JOURNAL Sept. 5, an unintentional injustice was done J. B. Fleming in that, through an inadvertent and regrettable omission, he was not given credit due him in connection with the plant described. Mr. Fleming was connected with the Consolidated as mechanical engineer for the new mill for six months, and it was under him that the original design of the mill was worked out, the specifications drawn up, and the contracts for machinery and structural steel were let. Moreover, many of the innovations in the mill are not only due to Mr. Fleming, but are his own designs.

PERCY E. BARBOUR.

Goldfield, Nev., Sept. 24, 1908.

Iron Production in France

Pig-iron production in France for the half-year ended June 30 is officially reported at 1,797,843 metric tons in 1907, and 1,746,634 in 1908; a decrease of 51,209 tons, or 2.8 per cent. More than half the iron reported this year was basic pig. The raw material used this year was 3,862,252 tons ore mined in France; 854,837 tons ore imported, chiefly from Luxemburg and Lorraine; 329,055 tons scrap, cinder and pyrites residues; a total of 5,046,144 tons, being an average of 2.89 tons per ton of iron made. This indicates an average iron content of about 35 per cent.

The Cyanide Correspondence Club of Mexico

Several metallurgists who are actively engaged in Mexico have suggested the formation of a club or association which will enable those engaged in cyaniding in that country to exchange experience and ideas, for their mutual benefit. Owing to conditions in Mexico this would have to be done through correspondence rather than by meetings. The plan, which was originated by Bernard Macdonald and others, is embodied in the following circular letter which has been sent to a number of metallurgists and mill managers.

THE CIRCULAR LETTER

The possible advantages of a "Cyanide Correspondence Club of Mexico," or a club of any suitable name, having for its objects those outlined or suggested below, will be obvious to all engaged directly, or indirectly, in cyanidation.

The cyanidation of gold and silver ores is now carried on in a large scale in Mexico and the application of this process in the recovery of these metals will increase rapidly. This is especially true of the mines producing dry silver ores, which at the present low price of the metal cannot be operated profitably by the old methods —pan-amalgamation or the patio process. This class of mines predominates in Mexico, and if they continue to operate they would be obliged to substitute cyanidation for present methods; and where mines of this character exist containing large bodies of ore too low grade to be worked by other methods, modern cyanide plants properly constructed and managed by practical and competent men would probably make such mines exceedingly profitable.

The field for substitution or employment of cyanidation in the metallurgy of silver ores, is, therefore, very broad and wide in Mexico and those engaged in the technical or managerial capacities in existing cyanide plants, or interested in such in a proprietary way, or having prospects of becoming interested in such capacities, would be greatly benefited by being members of such a club.

In other countries where the cyanidation of ores is carried on to a large extent, as in some of the districts in Australia and Africa, there have been organized technical clubs having regular meetings where the reading and discussion of papers on the problems involved in the chemistry and practice of the process, or in the mechanics of plant construction, are the main features. Such associations have greatly advanced the chemistry and mechanical science of cyanidation.

In Mexico regular meetings of members would be impracticable, owing to the great distances separating the districts and the disadvantage of the members being absent from the plants with which they are connected. There is no reason, however, why the same objects might not be attained as well, or even better, by the organization of a correspondence club having provided for its purposes the use of a monthly journal, one already existing and devoted to mining and metallurgy, wherein the correspondence of the members would regularly appear and reach all. Such a journal would become the official organ of the club.

It is probable that there are at least 500 people in Mexico who would be eligible and glad to join such a club, under the following qualifications, which would entitle applicants to membership.

1. Proprietors, managers, or superintendents of cyanide plants.

2. Chemists engaged in cyanide plants as such.

3. Inventors of mechanical or chemical methods used in the process.

It should be an obligation of membership that each member should contribute a paper, on plant construction or the technique of practice or statistics at some plant within a year from the time of becoming a member.

Papers need not be lengthy and could be compiled leisurely at odd times that would not interfere with the ordinary duties of the writer.

The papers or transactions should be revised and compiled into semi-annual volumes, which would constitute an important part of the world's literature on cyanidation and be of great value to the industry.

Ancient Plants at Guanajuato, Mexico

BY MARK R. LAMB

Guanajuato had many old treatment plants which lined the river banks from La Presa to far below Marfil. During the 5-km. ride from the railway terminus to Guanajuato on the street cars the ruins of these old plants form an almost continuous line; and guard-houses, high walls, horsepower wells and extensive paved patios are now in ruins, while past them runs the stream carrying at least 1000 tons of barren sand and slime from modern cyanide plants.

It is said that a few centuries ago, when Guanajuato was in its glory, the King of Spain sent an examining engineer to ascertain the advisability of getting control of some of the richer mines. This engineer reported that the difficulties of mining, losses by theft and bandits, church and treatment expenses were so great that he advised the King to be satisfied with the taxes then being paid. He described in detail the amounts exacted by the church, the cost of guards, the constant driving of labor necessary to make expenses at the *haciendas* and stated most decidedly that the King could get no agents who would work for him as the owners did for themselves. His final summary was to the effect that the King was better off with his taxes than if he could acquire the mines at no cost!

Chronology of Mining for September

Sept. 1—Engineers gain control of the burning oil gusher of S. Pearson & Sons at Dos Bocas, Mexico.

Sept. 4—Fire destroys the town of Rawhide, Nevada.

Sept. 10—The United States Circuit Court for the Eastern District of Pennsylvania decides that the "commodity clause" affecting the transportation by railroads of coal owned by them is unconstitutional.

Sept. 14—It is announced that all properties of the Tennessee Coal, Iron and Railroad Company will be in operation on Oct. 1.

Sept. 16—The board of directors of the Davis-Daly Copper Company elects F. Augustus Heinze president and Newman Erb chairman of the board. The Montana State Railway Commission orders cuts in freight rates on ore shipments from all parts of the State.

Sept. 18—Vice-President Ramon Corral of Mexico declares semi-officially that the section of the new mining law obnoxious to foreigners will not be passed.

Sept. 23—The Oliver Iron Mining Company calls for bids on a $1,500,000 concentrating plant on the west end of the Mesabi range. Export business in iron and steel is reported to be normal.

Sept. 24—Trustees in bankrupcy offer for sale the property of the Consolidated Arizona Smelting Company, including the smelter at Humboldt, the Blue Bell mine and stock in the De Soto Mining Company.

Sept. 25—A deal is reported consummated between the Hubbard-Elliot Mining Company owning extensive copper properties in Alaska and L. Hirsch & Co., of London involving the organization of a new $30,500,000 corporation.

According to Consul A. G. Seyfert, of Owen Sound, Ontario, one-half of all the cement produced in Canada is manufactured in the locality of Owen Sound, the daily output here being 3000 bbl. The demand for concrete material for building the transcontinental railroad has increased the output to the full capacity of the plants during the past year. During 1907 Canada produced 2,500,000 bbl. of portland cement, and imported 1,000,000 bbl. more, nearly all from the United States.

At the Alaska Treadwell mine, one pound of chrome steel in the shoes crushed 2.94 tons of ore in the 240-stamp mill and in the 300-stamp mill, 2.34 tons during the year ended May 31 last.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of of their movements and appointments.

W. E. Pomeroy is in charge of El Salto mill, at Ocampo, Mexico.

John E. Rothwell, mining engineer and metallurgist, of Denver, has been visiting New York and Philadelphia.

Charles Briggs, president of the Calumet & Arizona Mining Company, is at present at Cleveland, Ohio.

N. E. Isbell, of Goldfield, Nev., has been making an examination of the Paymaster gold mine, Manitoba Lake, Ontario.

W. J. Mitts has taken charge of the property of the Brazilian-Monitor Mining Company at Silverton, Colorado.

Henry F. Lefevre has been for two weeks past engaged in examining mines in the Georgetown district in Nevada.

M. D. Murray has been appointed superintendent of the Rio Tinto copper mine at Terrazas, Chihuahua, Mexico.

Thomas Cole, president of the Oliver Iron Mining Company, has been inspecting some mines in the Lake Superior copper district.

W. D. Pierce, manager of the Almoloya mines, has returned to Parral, Mexico, from Las Vegas, Nev., where he has been for some time.

Edward K. Judd, mining engineer, has returned to New York after several weeks' spent in examining mining property in Newfoundland.

Thomas Hoatson, managing director of the Keweenaw Copper Company, has returned after attending a meeting of the company at New York.

Frank C. Morehouse, manager of the Alvarado Consolidated Mines Company, has returned to Parral, Mexico, from a trip to the United States.

Gordon R. Campbell, secretary of the Calumet & Arizona and the Superior and Pittsbury companies, is in the Butte district in Montana on business.

G. R. Young, of Yonkers, N. Y., has just returned from Brazil, where he has been erecting a Link-Belt-Company dredge for the Diamond King Mining Company.

Donald M. Levy, of the University of Birmingham, England, has reached New York after a tour of inspection of the copper mines and smelters of Montana and Tennessee.

Daniel Guggenheim, president, and other officials of the American Smelting and Refining Company, have been making an inspection of the Utah and Nevada enterprises operated or controlled by the company.

Willard S. Morse, who has represented the executive committee of the American Smelting and Refining Company, at Salt Lake City for some time past, has been relieved and will return to the New York headquarters of the company.

J. M. Boutwell, who has been engaged in mining work for the Government in western districts during the last 10 years, has resigned his position as geologist on the United States Geological Survey. He will engage in mining geology for private interests, and is now on his way from Washington to Bisbee, Arizona.

Jesse Knight, the prominent Utah mine operator, who was recently nominated by the Democratic State convention for governor of Utah, declined the honor, preferring to devote his energy to his mining affairs. Being exceedingly popular, Mr. Knight would undoubtedly have been elected had he consented to make the race, as he would have polled a large vote from the opposing party.

Obituary

O. A. Caldwell, formerly of Pocatello, Idaho, but recently connected with the Minas Tecolotes y Anexas at Santa Barbara, Mexico, died at that place Sept. 15, of heart failure.

Cabell Whitehead, formerly for several years assayer of the United States Mint, and a writer on technical questions, died of pneumonia at Nome, Alaska, Sept. 7. He was born in Lynchburg, Va., and graduated from Lehigh University. He was 45 years old.

Andrew Stephens Patterson died at Pittsburg, Penn, Sept. 25, aged 59 years. He was born in Wheeling, W. Va., but had lived in Pittsburg 35 years. He was for the greater part of that time an active coal operator in the Pittsburg district, and had been president of the Patterson Coal Company for five years.

Dr. Theodore Peters, director of the Verein deutscher Ingenieure, died Sept. 2. Born in 1841, at Menden, near Siegburg, Germany, where his father owned a forge, he became an engineer, and for a while was a partner of the firm of A. H. Oechelhaeuser, at Siegen. In 1882 he became manager of the society above named, and in 1891 succeeded Dr. Grashof as director. As editor he developed the *Zeitschrift des Vereines deutscher Ingenieure*, until it is now one of the more important technical journals in Germany.

Societies and Technical Schools

Northwestern University—At this institution at Evanston, Ill., Dr. George R. Mansfield, of Harvard University, has been appointed assistant professor of Geology to succeed Prof. J. W. Goldthwait, who goes to Dartmouth College. Prof. Mansfield will begin work in February, 1909. C. E. Decker has been appointed instructor in Geology at Northwestern University for the first half of the present year, and D. F. Higgins, Jr., assistant. Prof. J. H. Cline, of Bridgewater College, Virginia, has been appointed a fellow in the same department.

West Virginia Mining Association—This association will hold a general meeting in Charleston, W. Va., Oct. 7. The association expects to have as its guests at that time George Otis Smith, director of the United States Geological Survey; Edward W. Parker, chief of the Bureau of Mines and Minerals; Dr. J. A. Holmes, chief of the Bureau of Technology; Captain Desborough, inspector of explosives for Great Britain; Victor Watteyne, engineering chief for the Administration of Mines, Belgium; and a number of representatives from the mining departments and universities of this and other States.

The meeting will open at 2 p.m., Oct. 7, when the association will extend a welcome to the distinguished scientists from abroad, to the members of the United States and West Virginia Geological Surveys, to the representatives from States and to other guests. Following the introductions the afternoon and evening will be given to the discussion of matters relating to the advancement of the mining industry in West Virginia and special papers will be presented as follows:

1. The Effect of Legislation on the Mining Industry in West Virginia.

2. The Proper Relationship Between Capital and Labor in West Virginia Coal Mining.

3. Recent Mine Disasters—Causes and Remedies as far as Ascertained.

4. Is Dust, as such, Explosive, and if so, What are the Chemical Reactions and the Most Efficient Preventives?

5. The Standardization of Powders and Explosives for Underground Workings.

6. The Advisability of Standardizing Electrical Appliances in Mines.

7. The Education of Mine Managers in Rescue Work and the Danger Involved by Untrained Men Attempting such Work.

8. Mine Fatalities in West Virginia as Compared with other Countries and the Present Methods Pursued by the Mine Department of West Virginia in Tabulating the Same.

A special train has been placed at the disposal of the association and will leave Charleston at 8:45 a.m., Oct. 8 for a trip to Princeton, Mercer county and return. The opportunity will be given to study all of the formations belonging to southern West Virginia. Starting from Charleston, which is within two miles of mines in the Pittsburg seam, the excursion will cross in succession the coals belonging to the Kanawha-Allegheny, the New River and the Pocahontas measures. Short stops will be made at the mines of the Loup Creek Collieries Company, at Page; the New River Collieries Company, at Eccles; the mines of the Slab Fork Coal Company and possibly one or two additional points.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Salt Lake City, Denver, Butte and Indianapolis

REVIEWS OF IMPORTANT EVENTS

San Francisco.

Sept. 23—The El Dorado Gold Dredging Company, which has been operating intermittently in the Folsom dredging field, Sacramento county, for several years past, finally closed down operations this week, having been unable to make any profit from its work. The company has paid off its labor account, but still has about $20,000 of debts to liquidate. The stock is unassessable, and the wealthier stockholders refuse any longer to carry those who are unable to pay their proportion of expenses. Repairs to the machinery have been excessive and constant breakdowns involving heavy expenses have dissatisfied the stockholders. By some the failure is attributed to poverty of the ground, and by others to lack of strength in the machinery.

According to advance figures published by the U. S. Geological Survey, the gold production of California in 1907 was $16,727,928 and the silver $751,646. This is a decrease in gold of $2,004,525, and of $66,182 silver. The reasons for this reduction are not far to seek and do not have much of anything to do with the actual conditions of the gold mines. The greatest falling off in gold yield, more than half a million dollars, was in Calaveras county, where, during 1907 the most productive mines in the county, at Angels, were closed several months by a miners' strike. In Grass Valley district the mines were also disturbed by strikes for two months and some others made less output than usual, so Nevada county shows a reduced yield. In Butte county, which is a quarter of a million below the record of the year before, the floods in the spring of 1907 wrecked a number of dredges altogether, and badly damaged several others. Both in the Oroville and Folsom dredging fields, that industry suffered from lack of steady electric power, much time being lost. In some other counties large operators quit during the financial stringency.

There is a stampede of gold seekers to Silver Lake, about 15 miles south of Mono Lake, in Mono county, especially from the southern Nevada camps. Numbers of men are also going in from Bodie, Bridgeport, Benton, and Bishop, in Inyo and Mono counties. The rich ore strike which has occasioned this excitement was made by a man named Miller, from Rawhide, Nev. This ore was found toward the upper end of Rush creek, on a direct air line between the May Lundy and Mammoth mines, two of the rich properties of that section. Several hundred men are encamped near the new prospect.

The old Coolgardie dry-washing placers, 25 miles north of Barstow, San Bernardino county, are again being worked, this time by the Coolgardie Mining Company, which has a couple of thousand acres of the channel ground. The gravel is shallow, it being only about 3½ ft. to bedrock. Considerable gold was taken out in this district years ago, but none of the dry washers had sufficient capacity to make the workings profitable. After considerable rather extensive experiments, the company devised and patented a dry washer, which would handle 100 tons of gravel daily, and this has been working recently in such a satisfactory manner that seven more of the same type have been ordered in Los Angeles. The hundred tons of gravel is concentrated into one ton, and these concentrates are worked in a smaller machine of the same pattern. A. R. Gibson, W. M. Hine, and J. B. Renshaw, of Los Angeles, are members of the company operating this ground at Coolgardie.

The directors of the Associated Oil Company have authorized an increase of the capital stock of that corporation to the extent of 102,630 shares of treasury stock of the par value of $100 a share. The new stock will be offered the present holders of stock certificates pro rata at $25 a share, the total proceeds to the company, therefore, amounting to $2,565,750. This is the last of the company's treasury stock. It is announced in a circular issued by the directors that the proceeds of the sale will be used in liquidating the indebtedness of the corporation, in acquiring additional properties and making betterments.

The sum of $26,000 has been paid for the Larimer quartz claim by the North Star Mine Company, at Grass Valley. The sale was made by decree of court, a partition suit having been brought between owners of the Larimer estate, the suit being of a friendly nature to enable the sale to be made. The property adjoins the North Star holdings and comprises about 20 acres. It carries with it seven water rights, which are valuable.

The Natoma Development Company, which entered the dredging field at Folsom this year, has had three dredges operating there for the past two or three months and a week since started up a fourth one. The new machines which are equipped with 13-cu.ft. capacity buckets, are handling now over 250,000 cu.yd. of auriferous gravel per month, and are making a record in the matter of cost.

Salt Lake City

Sept. 24—Utah-Apex shareholders have elected directors for the ensuing year consisting of Willard F. Fitzgerald and James D. Casey, Brookline, Mass.; Charles A. Moore, New York; Henry Bradley, Bangor, Me.; R. F. Hoffer, Jr., Fall River, Mass.; John W. Horne, Edward R. Hastings and John P. Gorman, of Boston; Cowley Lambert, London, Eng. The Utah-Apex mine is shipping 40 tons of high-grade silver-lead ore to the smeltery from which a profit of $750 a day is being realized.

The South Columbus Consolidated Mining Company, operating at Alta, has absorbed the Columbus-Wedge Mining Company, owning adjacent property, by increasing the capital stock from 300,000 to 500,000 shares, holders of shares in the latter corporation getting 115,000 shares of the new stock.

The Cedar and Talisman mines in Beaver county have been consolidated and will be operated hereafter by the Cedar-Talisman Consolidated Mines Company. Both properties consist of 15 lode claims, are producers of silver-lead ore and are well equipped.

A local branch of the American Mining Congress is about to be organized with a membership of about 100 persons. A vigorous effort is being made to secure the location of the headquarters of the congress for Salt Lake and the building of a large mining temple here, for which substantial sums of money have already been pledged.

Butte

Sept. 24—The Western Mining Supply Company has begun suit against James Breen, John MacGinniss and B. T. Spaulding, a copartnership, doing business under the name of MacGinniss & Spaulding, for $1124.71 for machinery alleged to have been furnished. MacGinniss & Spaulding entered into an agreement last fall under which they were to build a mill and develop the property of the Montana Gold Mountain Mining Company, situated 18 miles south of Butte. The firm also held an option on the stock of the company. It is for machinery alleged to have been furnished for this mill that the action is brought.

Recent negotiations at Helena between the coal miners and operators of Montana, held with a view to settling the differences which have arisen in regard to the wage scale, came to an end last week without any decision having been reached.

No strike is anticipated at present, however, since the miners intend to take the matter up with their national officers before taking further action.

The outlook for Butte's coal supply was bettered materially the early part of this week when four mines at Glencoe and Diamondville, Wyoming, employing 500 men, resumed operations after a shutdown due to difficulties arising over the wage scale.

The reorganization of the Davis-Daly Estates Copper Company by means of the formation of the new Davis-Daly Company, is gradually assuming tangible form. For a time it was feared that differences of opinion over the personnel of the board of directors of the new company would result in a deadlock. The underwriters insisted that an entirely neutral board be put in charge, while those in control of the old company thought that they should be well represented. The matter was finally settled by the resignation of G. Wesley Davis, who was one of those elected director at the first meeting of the new company. The board, as finally decided upon, consists of F. Augustus Heinze, Newman Erb, Samuel F. Jarvis, John C. Montgomery and H. Mason Raborg. A circular letter has been sent to the stockholders explaining the plan for reorganization and the exchange of the old shares for those of the new company and urging stockholders in the old company to take advantage of the offer.

Denver

Sept. 24—The Sugar Loaf district, which is as old as the Leadville district itself, has had rather a fitful career. When silver was high, some important strikes were made, and some of the mines have produced extensively. The mines are entirely in the granite, and the veins, on reaching a moderate depth, are very wet. One of the largest producers has been the Dinero, and it is pleasing to read that the deep tunnel which has been for some time in progress, with the object of draining the mine at considerable depth, has just intersected a vein at 3400 ft. from the portal. The vein is reported to exceed 12 ft. in width, and to run well in silver. This strike has attracted renewed attention to the Sugar Loaf district, and revived many of the old theories of the granite area under the Leadville limestone district being itself productive, and that fissure veins will be found in the granite below the sedimentaries of Leadville, similar to those of Sugar Loaf, but I do not believe that any experienced geologists or mining men take much stock in this theory. The mines of Sugar Loaf are seven or eight miles distant from Leadville.

In driving a lateral to the northward from the Yak tunnel, in the eastern portion of Iron Hill, Mr. Dyatt has disclosed a large body of ore. By some persons it is contended that this is the northeastern extension of the North Iron mine oreshoot, which was lost or exhausted years ago, while others believe it to be an entirely new shoot. The find is an important one, whichever view is accepted.

In California gulch, just west of the Iron Hill fault, at a depth of 500 ft. under the gulch, a body of lead-carbonate ore has been uncovered, which reminds one of the olden days. The ore is composed largely of gray-lead sand, and heavy, hard carbonate of lead. The ore is the western extension of one of the ore-shoots that yielded so largely in the Silver Cord territory in the past. Additional development is required to show the full magnitude of the find.

A number of laterals are about to be started from near the breast of the Yak tunnel, and new discoveries in Little Ella hill may be expected in the near future.

Though it has come about somewhat late in the season, the Red Mountain mines, between Ouray and Silverton, have taken on a new life, and activity is everywhere evident. A good deal of this is due to the fact that the head of the Red Mountain Mining and Railway Company has come in and paid off all the indebtedness; the delay in payment was largely due to the financial slump which overtook him last autumn. He now has a large force of men at work, and is driving the Joker tunnel and the Gennessee-Vanderbilt tunnel. The Yankee Girl mine is also being unwatered, and is shipping one car of ore per day. At Ironton, the Mono-Baltic Company, a Boston corporation, owning the Saratoga group of about 200 acres, is clearing the site for a pyritic smelter to be built in the spring. At Red Mountain, the San Antonio mine is working 40 men, and shipping 50 tons per day, averaging 12 per cent. copper, 10 per cent. lead, 10 oz. silver and $3 gold. The company is also running a tunnel from Sheridan Junction, a distance of 2300 ft. to the orebody, to cut it 500 ft. deep, or 300 ft. below the present workings. This will allow ore to be loaded directly on the cars of the Silverton railroad. A great deal of development work is going on, and the evidence is very strong that this district is getting on its feet permanently.

It is reported that during August, the mills of San Juan county shipped 2000 tons of ore to the smelters.

The Roosevelt deep drainage tunnel to which reference was made in this column last week, records the extent of progress as follows: The intermediate shaft is completed, and the headings were started in both directions on Sept. 11. At the present rate of progress, the portal heading should connect with the heading from the intermediate shaft about June next, while connection of the other heading from the intermediate shaft with the El Paso water-course should, at the present rate of progress, be completed about May, 1910. This drainage tunnel will then lower the water in the district 730 ft. below its present level.

A company which is said to control by lease and by options about 6000 acres of land within about two miles of Colorado Springs, is putting down a bore for oil, and mainly on the strength of a very strong report by J. W. Frank, an engineer of repute in the oil industry. Prof. Arthur Lakes also made a favorable report on this same locality. The indications as the well goes down are good, and the result will be watched with much interest.

Houghton, Michigan

Sept. 26—Rumors are current that large interests in the Franklin and Rhode Island mines are considering a consolidation of the two properties and also the acquisition of land from the St. Mary's Mineral Land Company. Should this amalgamation be consummated it is proposed to increase the authorized capital of the Franklin from 100,000 to 200,000 shares and to issue 45,000 shares of the new stock for the 100,000 shares of Rhode Island. The latter company owns 640 acres of land and has $40,000 in the treasury. If all the proposed plans are consummated the new company will have a working capital of $400,000 and 55,000 shares of stock in the treasury. The newly acquired land will permit farther sinking of the Franklin Jr. shaft and will give the Franklin mine an extension of the Pewabic lode on Rhode Island property. The combination would give the new company more than two miles carrying the outcrop of the Pewabic lode and nearly two miles carrying the outcrop of the Kearsarge lode.

The company would own all the available mineral land between the Quincy on the southwest and the La Salle on the northeast with practically unlimited depth for sinking on both formations.

Indianapolis

Sept. 28—Permission to transact business in Indiana has been granted to the United Coke and Gas Company, of West Virginia, and the American Coke and Gas Construction Company, of New Jersey, by the Secretary of State. Both of these companies are aiding in the construction and equipment of the Citizens Gas Company's plant, the company having a franchise to furnish gas at 60c. per 1000 ft. The United Coke and Gas Company has a capital stock of $2,500,000, and of this amount $60,000 is represented in Indiana. The American Coke and Gas Company is a subsidiary company of the other, and is capitalized at $400,000, with $50,000 represented in Indiana. The United Coke and Gas Company has the contract for putting in the by-product ovens, the main condenser house and the power plant in the Citizens company's plant. Both companies will maintain offices in Indianapolis.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Bisbee-Sonora—This property in the Chiricahua mountains is sacking its silver-lead ore for shipment to El Paso. The character of the ore has improved with development and the width of the orebody has increased.

GILA COUNTY

Arizona-Colorado—This company has encountered 30 ft. of mineralized vein matter on the 800-ft. level. Some of the body is commercial ore carrying copper and gold.

McMillen-Stonewall—The shaft on these claims is down below 200 ft. When the 300-ft. mark has been reached a crosscut will be driven to the old shaft. A cyanide plan is under consideration.

YUMA COUNTY

Clara Consolidated—In one of the large orebodies at the 160-ft. level a considerable amount of metallic copper has been encountered. The orebody continues to the 200-ft. level, and is apparently gaining in strength. The company is sinking to the 600-ft. level as fast as possible.

California

AMADOR COUNTY

Bunker Hill—On this property preparations are being made for sinking the shaft 400 ft. deeper and to open up two new levels.

BUTTE COUNTY

U. S. Diamond Mining Company—The work on the property of this company, at Cherokee, M. J. Cooney, manager, was ineffective in the spring months when there was too much water, but prospect shafts are now being sunk to find "blue ground."

Mammoth Channel Mining Company—This company, which is sinking a shaft at the inner end of the 1255-ft. tunnel, has cut a chamber for a gasolene hoisting engine, blower and pump.

EL DORADO COUNTY

Sunshine Mining and Development Company—This company has bonded considerable mining ground in Grizzly Flat district, and has undertaken its development.

INYO COUNTY

Kilian Mining Company—This property is to be opened up with power drills, the Casa Diable Company furnishing the electric power. The mill is to be placed on a flat 400 ft. lower than the mine, and the ore will be transported by an overhead cable line.

Bishop Creek Gold Company—Arrangements are being made to continue work during the winter and to erect a stamp mill on this property.

Casa Diablo Mining Company—This company is about to install a plant to treat its concentrates at the mine.

MODOC COUNTY

Hoag District—The Sunshine Mining Company, which recently began shipping bullion in a small way, will continue work through the winter. The Fort Bidwell Consolidated Mines Company is about to start its tunnel. A new company is about to start work on the Josephine, having bonded it.

NEVADA COUNTY

Oustomeh—This mine, at Nevada City, has formally been bonded by A. M. Gilbert, of Santa Barbara, and 20 men are at work. The mine is well equipped and has a 10-stamp mill.

Chicago Park—In this section, George Shebley is developing a quartz mine at the junction of Bear river and Greenhorn creek, on which there are three tunnels. A mill will shortly be erected.

Hill—At this mine, in the center of Grass Valley, a pit is being excavated for a pump, and a gasolene hoist is being put up.

Searchlight Mining Company—At this property, Washington, superintendent Hemmingsen is drifting on the Star ground for an extension of the Crown Point pay shoot.

Norambagua—A contract has been let to install a big compressor on this property at Grass Valley.

PLACER COUNTY

Bellevue Mining Company—This company is drifting in the 400-ft. level on a 2-ft. vein of pay ore.

White Oak—Through the tunnel in this mine the channel has been prospected and good pay gravel has been found.

PLUMAS COUNTY

Four Jacks—This group of claims on the Middle fork of Feather river in Nelson Point district, has been sold to C. H. Culp & Co., of San Diego. Tunnel work to develop the property is to be commenced at once, and work will be continued during the winter.

RIVERSIDE COUNTY

Hemet District—In this district M. Ruth, of Los Angeles, has purchased the Highland Tourmaline Gem No. 4, and interest in the O. J. W., Ruby, Tourmaline Gem No. 5, Kunzite, Point View and Black Lizard claims.

SHASTA COUNTY

Niagara—At this mine, French gulch, 20 men are at work on the shaft of the Surpion claims. A mill is to be built on the property this fall.

Drilling—A Keystone drill has been put in operation on the Dakin ranch, east of Redding, for testing the gold-gravel deposits in that section.

SIERRA COUNTY

Golden Rose—This mine, Alleghany district, recently bonded to Flynn Brothers and E. H. Wilson, is in bonanza, with a streak of ore running up into the thousands per ton. The mine is on the north side of the Middle Yuba mine, on the trail from Moore's Flat to Chipp's Flat.

SISKIYOU COUNTY

Yocum Group—At this claim in the Blue Ridge section of Salmon mine, a body of ore has been found, which is keeping the mill running steadily.

Dredge—J. A. Brent and associates are building a dredge at Hamburg bar. Various gravel bars along the Klamath river are to be dredged when the machine is completed.

Indian Girl—A new mill has been purchased for this mine at Hornbrook, and is being hauled to the mine.

TRINITY COUNTY

Chloride Bailey and Globe—For these mines at Dedrick an electrical equipment is being provided to furnish power to operate a 20-stamp mill.

TUOLUMNE COUNTY

Anaconda—This mine, owned by McKenzie & O'Hara, is producing good ore, and two shifts of miners are working.

YUBA COUNTY

A. B. Quartz Mining Company—Local men at Nevada City have organized this company to take over and work the R. & C. and the First and Last Chance mines at Brownville. Development will begin at once.

Brandy City—At this mine, Camptonville, 65 men are at work. A larger part of the flume has been completed. It will be nine miles in length when finished.

Colorado

LAKE COUNTY—LEADVILLE

Dinero Tunnel—About 100 ft. have been driven on the vein since the strike was made last week and the hanging wall has not been caught as yet. It is now understood that crosscutting will be started to locate the wall and to determine the width of the vein. Samples have been taken from different parts of the vein, and with all of the native silver in sight eliminated, gave returns of $150 per ton. There is a small proportion of gold and copper in the ore.

Big Six—With development work the body of ore recently opened in this property, Breece hill, continues to widen and shipments are now going out daily. The rich gold streak found in the center of the orebody still holds out and carries the same high proportion of gold; this ore is being sacked.

International Shaft—The large body of ore recently opened in this property, Robinson, contains a heavy percentage of milling ore, and the company will decide before the end of the month whether a mill will be erected at the mine or in Leadville. The probabilities are that it will be installed at the mine and act as a custom mill for the surrounding neighborhood. At present the property is closed pending the decision of the officials of the company.

Breece Hill—The Ibex Mining Company is producing in the neighborhood of 7000 tons per month of silicious and sulphide ores. Lessees on the Fanny Rawlins are shipping 50 tons daily of a high-grade ore taken from the lower levels. The Black Prince and Highland Chief are both producing a good grade of iron ore, and from the two shafts 50 tons daily are going out. The Gold Basin, M. N. Fraction, Little Vinnie, Penn and others are shipping regularly.

Coon Valley—The owner of this property, Rock hill, is installing electric power throughout the mine, and when completed work will be resumed on the orebody opened in one of the lower levels; the character of the ore is a lead sulphide.

Raymond Shaft—From the 300-ft. level shipments of lead and iron are going out steadily. The ore shoot is being developed toward the Reindeer.

Upper Arkansas—Considerable work has been done in this section during the summer with excellent results. A tunnel is being driven on the D. C. Bryan claim and at the breast a streak of ore was opened a few days ago that runs high in gold and silver. The gold is found in a soft gouge matter, while the silver is taken from a quartz vein.

OURAY COUNTY

Camp Bird—The London office reports that during August the mill ran 30 days and crushed 6748 tons, dry weight, of ore. The yield was 7368 oz. bullion and 411 tons concentrates. There was received during the month for bullion, $121,669; concentrates, $25.892; total, $147,561. Mine and other expenses were $46,360; London office, $1500; total, $47,860, leaving a net balance of $97,701. There was 314 ft. of development work done during the month; and the sum of $2788 was expended for construction.

Indiana

GREENE COUNTY

Crescent Coal Company—Two of this company's mines two miles east of Jasonville, on the Monon railroad, that have been idle since April 1, started operation during the week, giving employment to about 300 men.

SULLIVAN COUNTY

A surprise came this week when it was announced that the Antioch mine, the property of the United Fourth Vein Coal Company, would be closed. The mine has been in operation all the year. The managers state that it was impossible to obtain enough help at the mine during the busy season, and that another mine in this territory will be reopened.

WARRICK COUNTY

Within the last month over 500 oil and gas leases have been made in this county. These leases were made by the Standard Oil Company, the Pure Oil Company and a local company. Each company is working different sections of the county. Wells are being put down, and indications point to a prosperous season in this field.

Michigan

COPPER

Forest fires continue unabated throughout the upper peninsula and several of the outlying localities are in immediate danger. The Atlantic mine location is about surrounded and several of the scattered buildings have been destroyed. Everything possible is being done to fight the fires. To the north the Calumet & Hecla and Tamarack companies have had forces of men out all week to protect their pumping stations on the shore of Lake Superior. There has been practically no rain for the last two months and a strong breeze continues.

Lake—Drifting is under way from the 2nd level of the shaft at a depth of 300 ft. and the same high-grade mineralization is being encountered. The south drift from the 1st level is in 280 ft. and is breasted in the high-grade copper-bearing ground that has characterized it from the start. A new 20-drill air compressor has arrived at the property and will be installed at once; more drills will be added and a more progressive policy will be persued. The company has also purchased a high-duty hoisting engine, capable of operating from a depth of 2500 ft. With this additional apparatus the surface plant will be able to take care of all requirements for some time.

Keweenaw—An assessment of $2 per share has been levied on the outstanding shares of this company, to provide additional funds for the opening up of the property on a more extensive scale. The company has one producing shaft down 1160 ft. on its Medora tract and is shipping about 225 tons of rock daily to the mill; the rock averages about 16 lb. copper to the ton. It is planned to sink this shaft deeper and to extend the openings. The company expects to explore fully the adjoining lands, which are known to carry several of the productive lodes of the district.

Mass—This company has cut a 12-ft. vein with a diamond drill that is being operated from the 5th level of "A" shaft; the core taken out shows a well mineralized vein. Diamond drill operations are to be continued and the various lodes existing in that locality will be penetrated.

Missouri

JOPLIN DISTRICT

Kitty Mack—This company has incorporated with a capital stock of $25,000. The stockholders are Cincinnati and Joplin men.

Little Boss—This company will erect a second 100-ton mill on its tract at Granby.

Blackberry—Chas. Theurer has completed a tailing mill at this mine west of Joplin.

J. Wolley Mining Company—This company has incorporated with a capital stock of $75,000. The shareholders are from Evansville, Ind., and Joplin.

Hershel Mining Company—This company has incorporated with a capital stock of $25,000. The incorporators are Kansas City and Joplin men.

Oronogo Circle—This company is building a sludge mill to handle the sludge from five of its plants, and is installing 11 concentrating tables.

Continental Zinc Company—This company is installing a concrete-lined water column in its Prosperity mine for pumping the acid water. A 20-in. drill hole is put down and a 10-in. iron pipe placed inside. Around this 10-in. pipe concrete is run. When the acid water has eaten away the iron pipe the concrete column will remain.

Drillers—This company has put down four drill holes on its lease on the Rex land at Joplin and found ore in all of them.

United Zinc Company—This company has leased all its lands at Aurora to the Magnolia Lead and Zinc Company, a

corporation capitalized at $200,000, and with the following stockholders: L. W. Place and C. E. Hemp, of Hamilton, O.; W. F. Hilles, Dallas, Tex.; P. H. Fitspatrick, Syracuse, N. Y., and Fred Holt and F. B. Wilcox, of Joplin. The land comprises 131 acres in fee.

Montana

Butte District

East Butte—The work of unwatering the main shaft has been begun. About 250 ft. of water are in the shaft, which is more than 900 ft. in depth. Several weeks will be required to pump the shaft, and then sinking will be begun. At the same time a crosscut will be driven from the 900-ft. station, and drifting will be done on the lead.

Anaconda Company—The Anaconda mine has been closed down for the past few days because of gases generated from fires in the old stopes. It is not expected that the mine will remain closed for more than a few days. At the J. I. C. mine of the same company a new electric hoist is being installed.

Copper Eagle Mining Company—The shaft has reached a depth of 350 ft. Sinking will be discontinued, and development work on the orebodies begun.

Deer Lodge County

Cable Consolidated—About 10 men are working on the property. Most of the work is being done on the surface and consists of exploration shafts sunk for the purpose of locating the outcroppings of certain ore-shoots.

Southern Cross—It is reported that a new body of gold ore of considerable extent has been discovered in an excavation recently made for the foundation of a new building on the property.

Savage Property—Burt Adams Tower, a mining engineer, of Butte, is in charge of the mill.

Jefferson County

Boston & Corbin—Sinking is progressing rapidly and will be continued until the 1000-ft. mark is reached. At a distance of 700 ft. from the shaft on the 500-ft. level the Bertha lode has been cut. It is reported that the vein at the point of intersection is 2 ft. wide.

Nevada

Esmeralda County—Goldfield

Output—The production last week was much greater than usual owing largely to treating a bunch of "jewelry ore" in the Combination mill, but this is not included in these figures. The ore-handling companies handled 2461 tons of ore worth $168,450. Besides this, 5 tons of rich ore came from Montezuma and 40 tons of $400 concentrates were treated at the Kinkead mill by the new Consolidated process. The Combination mill treated 490 tons of Consolidated ores. The Western Ore Purchasing Company handled from the Engineers Lease, 243 tons; Florence Consolidated, 166; Consolidated Red Top, 125; Mohawk Jumbo, 344; Engineers dump, 25; Kinkead Concentrates, 98; Durgan & Flynn lease, 5 tons. The Nevada Goldfield Reduction Works treated from the Combination Fraction, 320 tons; Baby Florence, 70; Mohawk Jumbo dump, 75; Red Top Lease, 30; Begole dump, 325; Little Florence dump, 102; Black Butte Consolidated, 23; January dump, 20 tons.

Jumbo Extension—The De Foe lease was started again this week after a shutdown due to litigation.

Lone Star—Work has been started on the lease belonging to the Goldfield Star Leasing and Mining Company. A two-compartment shaft is being sunk to the 200-ft. level where a crosscut will be run to catch the vein formerly worked through an old incline shaft and from which $20,000 was extracted in the early days of the camp.

Sandstorm—The Prior & Quinn lease on the Sandstorm has been granted 18 months' time and the use of the Kendal shaft. The lease is unusually large, embracing 500 ft. on the Kruger and 600 ft. on the Magnolia claim.

Atlanta—The Maloney lease on block five has been extended for a period of nine months. The consideration is that the shaft, which is now 30 ft. deep, shall be sunk 200 ft. deeper.

C. O. D. Consolidated—The C. O. D. Fargo Mining Company has been formed with a capitalization of $1,500,000 to take over the old Fargo and C. O. D. Mining and Leasing Company's leases on the C. O. D. property. The Fargo lease has a life of 18 months. The shaft is 420 ft. deep.

Florence Consolidated—This lease on the Cornishman claim of the Florence property has found the oreshoot on the 173-ft. level and is shipping ore. The vein is trending toward the Jim Florence lease.

Jumbo Consolidated—The shaft is now 285 ft. deep; crosscutting has been started on the 250-ft. level.

Rustler Fraction—The Mountain Crown lease has reached a depth of 460 ft.; the shaft will be sunk to a depth of 500 ft. The water made in the shaft has decreased from 180 per 24 hours to 90 buckets.

Blue Bull—The Terrell & Cosser lease on the Hat claim of the Blue Bull has resumed operations after a shut-down lasting several weeks. This property has been working for the past three years. The shaft is 400 ft. deep.

Yellow Tiger—The Elk Consolidated lease, which was reported to have struck ore on the 580-ft. level, and which then immediately closed down, is said to have made arrangements for sinking the shaft.

Gold Bar Consolidated—A lease has been granted to the Nevada Gold Ore Mines Company for three years on the Gold Bar claim on condition that the shaft which is now 520 ft. deep shall be sent to a depth of 1000 ft. within 12 months.

Laguna—The Five Friends lease in the Last Chance claim of the Laguna has struck a low-grade vein in the shaft at a depth of 585 ft. Machine drills are used in sinking this shaft, and rapid progress is being made.

Combination Fraction—The Little Florence lease on this property is doing more development work than any other non-producing property in camp. In addition to three electric plants, a 40-h.p. gasolene hoist and an air compressor are being installed. Two compressors are now running, one having a capacity of 12 and the other of 8 drills. The three-compartment shaft, which is to be sunk to a depth of 1000 ft. has reached the 357-ft. level and a station is being cut. A new shaft has been started and equipped with machinery in the southeast corner of the leasehold. It is already 100 ft. deep.

Zinn Florence—This lease on the Florence has, owing to discovery of an error in surveying, secured a block of ground 20 ft. wide and 200 ft. long, on the side toward the Baby shaft. Work is being done in the 76-, 120- and 185-ft. levels.

Baby Florence—This lease, also on the Florence, has 30 in. of ore on the 150-ft. level, which gives sampler returns of $94 per ton. This stope is now 40 ft. long.

Consolidated—The new mill is growing rapidly. The 100 stamps are in place and will be given a trial run in a few days. The tube mills, as well as the driving gear and motors are all installed. Eight of the 16 settlers are built, also three of the large tanks for the Butters filter system. Four of the 45-ft. Pachuca tanks have been erected. The crusher plant is completed and ready to run except for the belts. The steel work for the sampling mill is all in place, and the steel work on the first two terraces of the main mill is practically completed.

Lincoln County

Alunite Mining Company—This company has been organized in New York to develop mines in the Railroad Pass district, 23 miles southeast of Las Vegas. A contract has been let to sink a two-compartment shaft, and other operations are planned. R. T. Hill, of New York, is the directing geologist of the company. C. L. Graves is president and W. D. Pearce general manager.

Nye County—Tonopah

Production—The week's production amounted to 5030 tons, valued at $135,900. The Tonopah Mining Company mined 2750 tons; Belmont, 480; Montana-Tonopah, 1070; Midway, 150; MacNamara, 250; Jim Butler, 90; Tonopah Extension, 90 tons.

Belmont—The company's 60-stamp mill at Millers is running every stamp and treating about 200 tons of ore per day that comes partly from the company's mines and partly from the MacNamara, West End, Jim Butler, Midway and North Star mines. The company intends to make some important changes in the mill. A Blaisdell distributor and excavator will be installed and possibly a tube mill.

New York

Knickerbocker Portland Cement Company—This company has concluded contracts with the American Cement Engineering Company, of New York, under which the latter will construct two cement plants on the Hudson river with a combined daily capacity of 12,000 bbl., and an annual output of not less than 4,000,000 bbl. of portland cement. Work will start almost immediately on the rebuilding of the present 2000-bbl. plant at Hudson, on the east bank of the river. Its daily capacity will be raised to 6000 bbl. The Engineering company promises to have the plant ready to reach a production at the rate of 2,000,000 bbl. annually, late next spring. The plant on the west bank, near Catskill, will have construction started early next year, and will be completed and in operation about a year from the date the foundations are started. Both contracts provide for machinery of the highest efficiency, and factory construction generally of the most solid type. These plants will mark the advances made in recent years in the use of electricity. The Knickerbocker Portland Cement Company has acquired about 1400 acres of limestone, shale and clay lands on the east bank of the river, and more than 500 acres on the west bank, with good railroad and water shipping facilities on both properties.

Oklahoma

Ottawa County

King Jack—This mine made its first turn-in last week and is installing Kirk concentrating tables.

Miami-Yankee—This company has begun the erection of a mill on its lease.

Drills—Twelve drills are at work within one mile of the Emma Gordon mine at Miami.

Good Luck—This company is erecting a new mill in the Quepaw camps.

Pennsylvania

Anthracite

Reading Coal Company—This company has drained old mine workings under the Schuylkill and Mahanoy valleys and is preparing to further develop the territory. It owns, in this locality, a valuable seam of coal of nearly uniform thickness and considerable length which will soon be mined.

Bituminous Coal

It is stated that H. A. Kuhn, president of the Pittsburg & Westmoreland Coal Company, near Monongahela, Penn., has invented a coal-cutting machine, which is said to be an improvement on all cutters now in use. The machine in operation is said to have cut coal at the rate of 1200 lb. a minute, while its advance into the vein was 3 in. a minute. This feat was accomplished while the machine was running at about 50 per cent. of its capacity. The passage was cut 10 ft. wide. Electric power was used.

The H. C. Frick Coke Company is to erect three new coke plants in the Connellsville region. The cost will be about $4,000,000.

Westmoreland Coal Company—This company has completed plans for the development of a large tract, of 20,000,000 acres which it has held in Westmoreland county for some time as a reserve. An appropriation of $1,000,000 has been made by the company for this work. Two mines are to be opened on the tract, and a new mining town is to be built, which will be named Yukon.

South Dakota

Lawrence County

Branch Mint Operating Company—This company, composed of Otto P. Heyn, Michael Hecht and other New York men, has taken over on five years' lease the property of the Branch Mint Mining Company at Galena and will operate at once. All Branch Mint labor claims, amounting to $20,000 were paid on taking the lease.

Queen Esther—At the annual meeting A. L. Kingdom, Warren, O., was chosen president; S. V. Pierce, Niles, O., vice-president; W. W. Conner, Columbus, O., secretary and treasurer; Stewart Conner, Tinton, general manager. Other directors include Ernest Mueller, Deadwood; John McVean, Terry; David Pugh, Mineral Point, O.; C. L. Hammond, Columbus, O. The operations will continue in shaft and tunnel.

Safe Investment—Patent to 1800 acres on Box Elder creek has been received and operations will be resumed next month. There are numerous large veins showing gold, silver and copper. The 40-stamp mill will be put in commission again and extensive development will be done.

Gold Ridge—H. B. Trathen and other local owners are negotiating for the sale of the property on Bear creek, where a good body of gold ore has been opened up. The mine is worked by tunnel.

Pennington County

Keystone-Holy Terror—Warner Gray, of New York, superintendent for the United Mines Company, is in Keystone making arrangements for reopening the property. All indebtedness has been paid and unwatering will commence in a few days.

Reynolds Ground—M. J. Scanlon and other owners have encountered a rich ore-shoot near Keystone. The rock carries free gold in a vein 3 ft. wide.

Texas

Production of petroleum in the southeast Texas district in August is reported by the *Oil Investors' Journal* at 922,800 bbl., an increase of 105,600 bbl. over July. Shipments of crude oil in August were 786,812 bbl.; of refinery products, 511,078 bbl. The well report shows 31 wells completed during the month, 21 being producers. There were 78 wells drilling at the end of the month.

Utah

Carbon County

Union Pacific Coal Company—The power house of the new mine at Winter Quarters was burned Sept. 28, the loss being $50,000. There were 50 men in the mine when the fire started, but all escaped.

Iron County

Jennie Gold Mining Company—The new management is in charge; shareholders have been called on for an assessment of 5c. per share, or $30,000, to meet immediate demands. It is proposed to make certain changes in the mill and to sink the shaft deeper as the mine is opened to a depth of only 130 feet.

Juab County

Tintic Standard—This property has been equipped with a new steam-hoisting plant.

Ajax—This property is shipping again after nine months of inaction.

Tintic Smeltery—The men in charge declare results achieved at this smeltery have been exceptionally gratifying.

Salt Lake County

Columbus Extension—This company has been developing its property in the Alta district for nearly three years; during this time $35,000 has been expended. The first orebody of any consequence was encountered last week when the adit through which the property is being developed cut the Flagstaff vein at a vertical depth of 1300 ft. The vein is about 8 ft. wide and the ore assays from 2 to 10 per cent. copper. The adit is 3500 ft. long.

Utah Apex—This mine, at Bingham, is shipping 50 tons per day of lead-silver ore. The mine is worked through the Parvenue adit, the lowest level in the mine.

Tooele County

Boston-Sunshine—Plans for the alterations in the mill owned by this corporation have been completed, and the changes will soon be made. The equipment will be similar to that in use at the Consolidated Mercur mill, four miles away.

Clift Mining Company—The mine at Ophir is shipping about a carload per day to the Salt Lake valley smelters.

Wisconsin

ZINC-LEAD DISTRICT

Empire—The litigation pending between the Empire and Enterprise companies, of Platteville, over alleged encroachment on the Empire land by the Enterprise company was settled this week, the Enterprise company paying $1000 damages.

Lyght—This company has purchased the 75-ton mill and entire surface equipment of the Rico and will remove it to the Lyght mine.

United States Zinc—This company has let a contract to the Galena Iron Works for the erection of a new roaster of the Galena type.

Union Zinc Company—This company has purchased the property and equipment of the Sunset and will reopen the mine.

New Jersey Reduction Company—This company proposes to build another custom roasting plant at Galena, with capacity to handle 150 tons of concentrates per day.

Platteville—The plant of the Electrostatic Separator Company is closed down to make alterations and enlargements. The company has become an active buyer of the low-grade pyritic zinc ores from which it extracts a salable pyrite or sulphur ore assaying 42 to 46 per cent. sulphur, that is being successfully marketed.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending Sept. 22 were as follows: Coniagas, 63,000 lb.; Crown Reserve, 60,000; Chambers-Ferland, 61,000; Foster, 58,900; La Rose, 189,250; Nipissing, 377,280; Nova Scotia, 40,500; O'Brien, 137,900; Right of Way, 122,850; Temiskaming & Hudson Bay, 60,000; Watts, 80,590; Total, 1,199,779 pounds.

Gould Consolidated—This company, which is working two properties leased from the Peterson Lake company has installed compressor drills and a hoist; power is furnished by the Nipissing company.

Temiskaming & Hudson Bay—Recently a vein was struck within 10 ft. of the Trethewey mine in the drift at the 100-ft. level. It is 5 in. wide and is rich in silver.

La Rose Consolidated—An initial dividend of 3 per cent. for the quarter ending Aug. 31 has been declared.

O'Brien—A rich vein 4 to 5 in. wide has been struck in crosscutting at the 175-ft. level, 60 ft. from No. 2 shaft. It is said to assay 2800 oz. silver to the ton.

Rochester—The directors have decided to sink the main shaft, now down 90 ft., to the 200-ft. level. Stoping will be commenced at the 80-ft. level.

Silver Leaf—The shaft is down 204 ft. with driftings at the 75-ft. and 135-ft. levels. A station has been cut at the 200-ft. level. The main vein shows the entire depth of the shaft and at the bottom has a width of 5 in. of calcite and silver nearly free from cobalt. A 6-in. calcite vein, encountered in a crosscut at the 135-ft. level, at a distance of 109 ft., has been drifted on for 137 ft., disclosing good silver.

Silver Spade Mining Company—This company holds four claims in South Lorraine township, from which satisfactory assay returns have been received. A force of men under Superintendent Thomas R. Allison has begun development work.

Temiskaming—The new shaft is down 90 ft. A new 20-drill Corliss tandem air compressor and a large hoist have been ordered. The rich vein at the 200-ft level has widened to nearly 3 feet.

ONTARIO-TEMAGAMI FOREST RESERVE

Otisse—This property, comprising 40 acres situated 6 miles west of Elk City, has been sold to E. D. Warren & Co. Native silver has been discovered and work will be commenced at once by a force of 25 men in charge of Robert Longley.

Beaver—The main vein is now down 225 ft., at which level a drift has been started to tap the big vein of the Temiskaming mine.

Buffalo—Many improvements and additions to the plant have been made. A 125-h.p. boiler is in place in the new boiler house and a cyanide plant is being installed in the new addition to the mill building. New crushers, rolls and tables are being added to the concentrating plant, increasing the capacity to 100 tons daily. Two nuggets weighing 1500 and 500 pounds respectively, carrying 5000 oz. to the ton, were recently taken from the 80-ft. level in No. 12 vein.

Nova Scotia—A sample of rich ore, taken from the 150-ft. level, weighing 160 pounds and valued at $850, is on exhibition in Toronto.

NOVA SCOTIA

Dominion Iron and Steel Company—In the suit against the Dominion Coal Company, the Steel company has obtained a peremptory order from the British Privy Council compelling the Coal company to file its case within 14 days from Sept. 14. On Aug. 14 an order was issued calling on the Coal company to enter its case. The Coal company having taken no action, the peremptory order was issued. Should the Coal company be in default when the time expires, the Steel company can either force a hearing or obtain the dismissal of the appeal.

Dominion Coal Company—Operations have been slackened in view of the decreased demand. The company has closed down the East slope at colliery No. 5 and is making other curtailments, affecting in all about 400 men.

ONTARIO—MICHIPICOTEN DISTRICT

Helen—The Lake Superior Power Company, which is operating this iron mine, is making extensive improvements in the equipment, including the introduction of electric power. An electric-generating plant is to be installed on the Michipicoten river, where there is a fall of 128 ft. This includes a 1000-h.p. single, horizontal turbine connected with a 600-k.w. alternating-current generator. Transformers will reduce the pressure from 10,000 to 600 volts. An air compressor, operated by a 200-h.p. motor, and other mechanism for the hoists, etc., will be installed at the mine. The contract for electrical equipment has been given to Allis-Chalmers-Bullock, Ltd., of Montreal.

Mexico

DURANGO

Indé—The mill is treating about 100 tons of ore daily from the Mina Terrible. The cyanide process is employed.

Guadalupe—This company is extracting gold bullion from about 100 tons of ore daily. Power is generated in a plant on the river about five miles from the mine.

GUANAJUATO

Production—The output for the third week in September showed a marked falling off. The shipments of ore and concentrates were less than in the preceding week and also the shipments of bullion.

Guanajuato Reduction Company—The ore handled during the month ending Sept. 21 amounted to 16,120 metric tons. The new aërial tramway is transporting daily 150 tons of ore from the mine to the Bustos mill at a cost of 6c. per ton.

SONORA

Chispas—This mine at Arizpe is making regular shipments of ore by burro train to the Sonora railroad. The guards are doubled because of the activity of the Yaquis. The Carmen mine, which adjoins the Chispas, is reported to be preparing to resume.

VERA CRUZ

Dos Bocas Gusher—Although the fire of the great oil well of the Pearsons was extinguished some time ago, the flow of oil and salt water continues, and it has thus far been impossible to get it under control. The pipe was blown out at the first outburst and the crater, now 100 to 200 yd. across, is widening. Troops have been at work building dams to inclose the oil, and a railroad contractor is preparing to undertake operations with a large force of men.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Sept. 30—The coal trade in the West is still improving, but very slowly. The weather is still warm enough to hold back domestic trade, while steam-coal demand increases irregularly. The Lake trade is slow for the season.

In the East bituminous trade rather drags. Anthracite business is dull also, owing chiefly to the continued warm weather which has prevailed.

Throughout Pennsylvania, both in the bituminous and the anthracite regions, mining has been hindered by the short supply of water resulting from the long drought. Some mines have been obliged to stop altogether, and others to cut down production for this reason.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Sept. 19, in short tons:

	1907.	1908.	Changes.
Anthracite.....	4,064,733	3,620,482	D. 443,251
Bituminous.....	27,957,480	23,424,136	D. 4,523,344
Coke.....	10,138,787	4,895,229	D. 5,243,558
Total.....	42,160,000	31,939,847	D. 10,220,153

Total decrease this year to date was 24.2 per cent.

Shipments of coal by water from Seattle and Tacoma, Wash., seven months ended July 31 were 416,650 tons in 1907, and 347,759 in 1908; a decrease of 68,891 tons.

Receipts of coal at St. Louis, seven months ended July 31 were 4,240,797 short tons in 1907, and 3,573,073 in 1908; a decrease of 667,704 tons.

Coastwise shipments of coal from principal Atlantic ports, seven months ended July 31, long tons:

	Anthracite.	Bitum.	Total.	Per Ct.
New York....	8,931,669	5,723,054	14,654,723	63.3
Philadelphia	1,265,849	2,656,703	3,922,552	16 9
Baltimore....	145,971	2,087,675	2,2 3.646	9.6
Newp't News	.....	1,462,626	1,463,626	6.3
Norfolk.....	.. ..	896,191	896,191	3.9
Total.....	10,343,489	12,827,249	23,170,738	100.0
Total, 1907.	11,310,253	13,564,270	24,874,523	.....

Total decrease this year, 1,703,785 tons, or 6.8 per cent. New York includes all the New York harbor shipping ports.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, seven months ended July 31, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	12,070,189	1,535,269	13,605,458
Buff., Roch. & Pitts.	3,040,035	201,233	3,241,068
Penn. lines, N. Y. C.	3,553,012	37,607	3,590,619
Pitts. & L. Erie.....	4,069,633	1,500,345	5,569,978
Norfolk & Western.	5,884,885	1,052,571	6,937,456
Total.....	28,617,754	4,326,825	32,944,579
Total, 1907.....	36,832,729	8,385,073	45,217,802

Decrease this year in coal 8,214,975 tons; in coke, 4,058,248; total, 12,273,223 tons, or 27.1 per cent. In addition to the above, the Baltimore & Ohio carried 584,301 tons anthracite in 1907, and 440,584 in 1908; decrease, 143,717 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, seven months ended July 31, short tons:

	1907.	1908.	Changes.
Hocking Valley.....	2,165,336	1,444,791	D. 720,545
Toledo & Ohio Cent..	994,618	695,578	D. 299,040
Baltimore & Ohio ...	1,260,230	771,191	D. 489,039
Wheeling & L. Erie..	2,001,865	1,489,099	D. 512,766
Cleve., Lorain & Wh.	1,649,158	1,352,969	D. 29 ,189
Zanesville & Western	932,736	613,514	D. 319,222
Toledo Div., Pen. Co.	1,369,635	864,911	D. 505,724
L. Erie, Alliance & Wh.	706,303	517,868	D. 188,435
Marietta, Col. & Clev.	14,787	26,332	I. 11,545
Total.....	11,094,668	7,775,253	D. 3,319,415

Total decrease this year was 29.9 per cent.

New York

Anthracite

Sept. 30—The hard-coal market seems to have settled back into the same lifeless condition which has prevailed for the last few weeks. Among the small steam sizes buckwheat coal is in fair demand for both No. 1 and No. 2; other sizes are inactive.

Schedule prices are $4.75 for broken, and $5 for egg, stove and chestnut. Steam size prices are unchanged: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50. All prices are f.o.b. New York harbor points.

Bituminous

There seems to be a slight improvement in the soft-coal trade and business has been coming in a little more freely. There have been a number of inquiries from shoalwater ports and it is expected that consumers from these points will soon contract for their winter's supply.

New York harbor trade is inactive and little business is being done. Good grades of steam coal fetch $2.50@2.65 with the poorer qualities selling around $2.40. In all-rail trade slack coal is quoted at 50c., run-of-mine at 85c. and ¾-in. gas coal at 90c., all f.o.b. mine. Transportation seems to have improved and cars are in good supply, although a few shortages have been reported.

In the Coastwise vessel trade there seems to be a shortage of vessels and freight rates are very firm, although unchanged from last week. Rates for large vessels from Philadelphia are: Boston, Salem and Portland, 50@55c.; Lynn, 60@65c.; Porthmouth and Bath, 60@65c.; Newburyport, Gardiner and Bangor, 65@70c.; Saco, 90c.@$1; Providence, New Bedford and the Sound, 45@50c. per ton.

Birmingham

Sept. 28—By degrees the coal production in Alabama is improving. The normal output is being approached and there appears to be a fairly good demand for the coal. The railroads have prepared themselves to meet all demands for empty cars. Coal prices are not improving.

The coke production shows signs of improvement. There is need for all the coke that can be manufactured.

Chicago

Sept. 28—The coal market for the last week has been listless. A sharp drop in the temperature over the Middle West has had the result, at the beginning of the week, of stimulating sales of domestic coals. Steam coals are not yet in so good demand.

Illinois and Indiana coals bring, in car lots, $1.75@2.50 for lump and egg; $1.50@1.75 for run-of-mine, and $1.20@1.50 for screenings. Lump has strengthened and fine coals have weakened.

Of Eastern coal smokeless is ragged, with run-of-mine at $3.05@3.45 and lump at $4.05@4.30. Youghiogheny is steady at $3@3.15 for ¾-in. coal on contracts. Hocking is steady at $3.15 with sales fair and supply well regulated.

Indianapolis

Sept. 28—The bill to amend the law providing for safety regulations for blasting coal relating to the size of the drill bit used by the miners in preparing blasts has been passed by the Legislature, now in extraordinary session.

The Legislature two years ago made it unlawful to use a bit larger than 2½ in. As amended and passed the measure gives the miners the right to use a 3¼-in. bit. The passage of the amendment was opposed by the Indiana Coal Operators' Association because heavy charges are conducive to mine explosions. It was claimed the law had amply justified its existence. About 90 per cent. of the miners favored the amendment, and it was unanimously passed.

Pittsburg

Sept. 29—Production in the Pittsburg district, which has been at the rate of about 85 per cent. has dropped to around 30 per cent. This is due to a falling off in Lake shipments and there is no in-

creased demand in the local markets. Prices, however, remain firm on the basis of $1.15 per ton for mine-run coal at the mine; slack ranges from 50c. to 60c. The river mines continue idle as there are no empty coal boats or barges to load and navigation is suspended owing to the long drought.

Connellsville Coke—The coke situation continues strong, although sales are not heavy. Prices are firm. Furnace coke is $1.65@1.85 on contract, and foundry $2.10@2.25 per ton at the ovens. These prices have been shaded considerably for prompt shipment. The *Courier* in its weekly report gives the production in both regions at 201,485 tons. The shipments amounted to 7878 cars as follows: To Pittsburg, 4167; to points west of Pittsburg, 3268; to points east of Connellsville, 443 cars.

Foreign Coal Trade

United States Coal Exports—Total coal sold for consumption beyond the limits of the United States, seven months ended July 31:

	1907.	1908.	Changes.	
Exported.....	7,133,730	6,484,976	D.	648,754
Steamship coal..	3,271,779	3,413,528	I.	141,749
Total..... ...	10,405,509	9,898,504	D.	507,005

The steamship coal is that furnished to vessels in foreign trade.

British Coal Exports—Exports of fuel from Great Britain, with coal sent abroad for use of steamships in foreign trade, eight months ended Aug. 31, long tons:

	1907.	1908.	Changes.	
Coal	41,405,273	41,123,374	D.	281,899
Coke.....	586,231	705,807	I.	119,576
Briquets.....	981,468	1,039,985	I.	58,517
Total exports...	42,972,972	42,869,166	D.	103,806
Steamer coal.....	12,364,530	12,803,762	I.	439,232
Total.....	55,337,.02	55,672,928	I.	335,426

The larger exports were to France, Germany, Italy and Sweden.

Welsh Coal Market—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of Welsh coal as follows, on Sept. 19: Best Welsh steam, $3.78; seconds, $3.54; thirds, $3.30; dry coals, $3.60; best Monmouthshire, $3.30; seconds, $3.12; best small steam, $1.92; seconds, $1.56. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Sept. 30—The iron and steel markets do not show any special advance. In fact, business has been rather quiet in most departments, so far as new orders are concerned. Structural plans of some importance are under negotiation, but the progress to the contract stage is slow. Railroad business is still held back, the only trade of this kind reported being a few orders for cars and two or three small ones for rails.

The pig-iron market has been dull, and small orders for early delivery have been the rule. Buyers do not seem yet to be sure enough of the future to place business far ahead.

Some export business is soid to have been placed, chiefly for Mexico and South America. Canadian business is also improving. The railroads are preparing a new adjustment of rates between Pittsburg and western points. It is understood that no general increase is proposed, the purpose being only to remedy some inequalities which have grown up.

Canadian Rail Exports—A Montreal despatch reports that the Dominion Steel Company, at Sydney, N. S., has closed a contract for 9000 tons of steel rails for export to India.

Baltimore

Sept. 28—Imports for the week included 450 tons spiegeleisen, 2620 tons ferromanganese and 500 tons ferrosilicon; 1560 tons manganese ore from Liverpool and 5500 tons iron ore from Cuba. Exports included 5874 tons steel rails, chiefly to Mexico; 280,118 lb. spelter to Glasgow.

Birmingham

Sept. 28—While the pig-iron market in this section of the country is not as active as it has been, it is steady, and the quotations are firm and inclined toward a higher plane. All sales made recently in this section have been in small lots for immediate delivery. The quotations are around $13 per ton No. 2 foundry. The shipments from this territory have been steady all along and there has been no accumulation of iron. The Sloss-Sheffield company is making iron again at Lady Ensley furnace at Sheffield, while the work on Philadelphia furnace at Florence is nearing completion. This will make six out of seven furnaces in operation with this concern. The Tennessee company will have two furnaces in Bessemer about ready a fortnight or so hence. Some few sales of iron have been booked in southern territory for delivery during the first quarter of 1909. The quotations for these are around $13 per ton No. 2 foundry.

The Bessemer rolling mills are still idle because of the scarcity of steel. The cast-iron pipe trade lags a little. Foundries and machine shops are doing a little better in this territory.

Chicago

Sept. 28—The market for pig iron and iron and steel products continues quiet. Small lots are the rule in the pig-iron purchases with few sales for 1909 delivery. Southern No. 2 iron holds to $12.50@13 Birmingham ($16.85@17.35 Chicago) for last quarter deliveries; for 1909 first-quarter deliveries $13.50 is generally asked. Northern No. 2 is somewhat wobbly about $16.50, some lots bringing 25c. less and some 50c. more. On business for next year prices are fairly firm; for this year they very according to individual conditions.

The market for iron and steel products continues fairly active, sales being steady in about every line except steel rails and structural material. Coke is firm but quiet at $4.90 for the best Connellsville.

Cleveland

Sept. 29—Iron-ore shipments from the upper ports will run over 4,000,000 tons for September, making a total of about 16,500,000 tons for the season. All the business, practically, is being done by the contract vessels, and there is no call for wild boats.

Philadelphia

Sept. 30—The large transactions in basic iron were not altogether a surprise to the trade here. The negotiations pending for additional blocks are expected to go through shortly. The fair volume of new business in plates and structural material has diverted attention to pig iron for steel purposes. Generally speaking, there is no demand outside of small lots for iron for quick delivery. Local foundry consumers are fairly covered for 30 to 60 days. Forge iron is at the tail of the list and averages $16, while No. 2X is dull at an average of $17.

Steel Billets—This branch of the industry is decidedly improved under the larger demand for finished products.

Plates—The car-building demand has benefited the Eastern mills to some extent. The boiler-shop demand is gaining.

Structural Material—Building work is calling for small lots of fabricated material, generally under 50 tons.

Rails—Apart from a few orders for light sections no business has been reported. The cutting of prices on large export orders is commented on in the trade.

Scrap—The scrap dealers report an indifferent demand. Railroad and heavy steel scrap are the only kinds moving.

Pittsburg

Sept. 29—No general advance can be noted this week in the iron and steel trade but there are still signs of an improvement. It is coming slowly and the complications in the political situation are held responsible for the failure in carrying out of former predictions. Business has not gone back any, and small orders continue to come in. Reports from small independent concerns show that there has been an increase in trade compared with the past few weeks. This can only be accounted for from the fact that the smaller interests are anticipating the action of the larger companies by shading prices and booking what little business is going. The large concerns are taking orders and keep-

ing their mills running but not on as large a scale as was anticipated a month ago. The National Tube Company is booking a considerable amount of small business. In addition it has taken one of the largest contracts placed for a year. It calls for 20,000 tons of gas pipe for the Columbia Gas and Electric Company for a line from the gasfields of West Virginia to Cincinnati. The Carnegie Steel Company is going to the extent of over 65 per cent. The American Bridge Company and the American Steel and Wire Company are running their plants to more than 50 per cent. of capacity. The American Sheet and Tin Plate Company shows a falling off in both its sheet and tinplate works but this is only temporary. The Republic Iron and Steel Company is operating about 70 per cent. of its capacity.

Pig Iron—The most important order taken this week calls for 2000 tons of basic iron for the Pittsburg Steel Company, the largest independent wire producer in the country. The price is not made public. The report that it also has purchased 2000 tons of steel billets is neither confirmed nor denied. There is no pig-iron market as to dealers and producers and it is characterized as a "consumers' market." This means that consumers who want iron can get it at almost any price in reason. Sales, however, during the week have been confined to carload lots. Quotations for prompt delivery are given as follows: Standard bessemer, $15; malleable bessemer, $14.50; basic, $14.25; No. 2 foundry, $14.50; gray forge, $13.50.

Steel—Bessemer and open-hearth billets are still quoted firmly at $25, Pittsburg, and no concessions are made, although there are a number of good inquiries. Merchant-steel bars remain at 1.40c. and plates at 1.60 cents.

Sheets—There is no decline in sheets and some good sales at the regular rates. Some independent producers are reported to be selling at less, but so far as known today all cutting has been stopped. Black sheets are quoted at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese—The price remains $45@46, Pittsburg, but the demand is stronger.

Foreign Iron Trade

German Iron Trade—Imports and exports of iron and steel, including machinery, in Germany, seven months ended July 31, metric tons:

Imports:	1907.	1908.	Changes.
Iron and steel	465,413	324,902	D. 140,511
Machinery	60,464	53,817	D. 6,647
Total	525,877	378,719	D. 147,158
Exports:			
Iron and steel	1,981,909	2,229,040	I. 247,131
Machinery	186,484	208,478	I. 21,994
Total	2,168,393	2,437,518	I. 269,125

The increase in exports this year is due to the action of the Steel Syndicate in pressing foreign sales.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Sept. 30.

At all U. S. Ports in August and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Aug. 1908..	$ 6,597,101	$ 4,257,255	Exp. $ 2,329,846
" 1907..	4,596,879	3,223,772	" 1,373,107
Year 1908..	64,960,348	33,614,330	" 31,346,018
" 1907..	48,375,977	28,103,201	" 20,272,776
Silver:			
Aug. 1908..	4,130,853	3,194,426	Exp. 936,427
" 1907..	6,748,085	4,882,622	" 1,865,463
Year 1908..	34,576,144	27,375,355	" 7,200,789
" 1907..	41,922,336	30,665,45[illegible]	" 11,256,878

Exports of specie from New York week ended Sept. 26: Gold, $506,125, chiefly to Argentina; silver, $810,016, principally to London. Imports: Gold, $760,909, from Australia, London and the West Indies; silver, $61,953, from Central America and Mexico.

Specie holdings of the leading banks of the world, Sept. 26, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$321,194,500
England	$192,854,200	.....	192,854,200
France	648,805,935	$180,145,475	828,951,410
Germany	206,125,000	85,545,000	291,670,000
Spain	78,590,000	169,555,000	248,145,000
Netherlands	38,842,500	19,767,500	58,610,000
Belgium	20,230,000	10,115,000	30,345,000
Italy	185,165,000	22,500,000	207,665,000
Russia	591,620,000	37,955,000	629,575,000
Aust.-Hungary	242,510,000	65,605,000	308,115,000
Sweden	20,660,000	.....	20,660,000
Norway	8,655,000	.....	8,655,000
Switzerland	22,945,000	.....	22,945,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Gold and silver movement in Great Britain eight months ended Aug. 31:

	Imports.	Exports.	Excess.
Gold	£30,671,542	£29,729,543	Imp. £ 941,999
Gold, 1907	31,138,557	21,503,887	Imp. 9,634,870
Silver	6,883,805	8,830,493	Exp. 1,946,688
Silver, 1907	11,181,054	11,943,172	Exp. 762,118

Silver Market

SILVER AND STERLING EXCHANGE.

Sept.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Sept.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
24	4.8640	51⅞	23 15/16	28	4.8640	51⅝	23 15/16
25	4.8640	51⅝	23 15/16	29	4.8640	51¾	23⅞
26	4.8640	51½	23¾	30	4.8640	51¾	23⅞

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Sept. 17:

	1907.	1908.	Changes.
India	£8,817,864	£6,557,063	D. £2,260,801
China	.....	516,400	I. 516,400
Straits	598,700	112,385	D. 486,315
Total	£9,416,564	£7,185,848	D. £2,230,716

Receipts for the week were £10,000 from Malta, £105,000 from Shanghai and £142,700 from New York: a total of £257,700. Exports were £1000 to Gibraltar, £22,000 to Singapore and £98,500 to India: £121,500 in all.

Silver continues steady, and with little change. Demand is good, but not sufficient to lift the price. The tendency is uncertain owing to the large speculative business which has been reported from India.

Copper, Tin, Lead and Zinc

DAILY PRICES OF METALS.

Sept.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
24	13⅜ @13⅝	13¼ @13⅜	60	29⅛	4 45 @4 50	4 75 @4 80	4 60 @4.65
25	13⅜ @13⅝	13¼ @13⅜	60¼	29½	4 45 @4 50	4 75 @4 80	4 60 @4 65
26	13⅜ @13⅝	13¼ @13⅜	....	29½	4.45 @4.50	4.75 @4 80	4 60 @4.65
28	13⅜ @13⅝	13¼ @13⅜	59¾	29¼	4.42½ @4.47½	4.75 @4.80	4.60 @4.65
29	13⅜ @13⅝	13¼ @13⅜	59⅝	29⅛	4.42½ @4 47½	4 75 @4 80	4 60 @4 65
30	13⅜ @13⅝	13¼ @13⅜	59⅞	29½	4.42½ @4.47½	4.75 @4 80	4.60 @4 65

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Since Sept. 23 there has been a little revival of business, particularly for export, but the transactions have not been active or of large volume. Business with domestic consumers has been insignificant. In short the market is almost at a standstill, producers waiting for buyers. There is no apparent anxiety to force copper on the market. One large producer of Lake copper is asking 14c. from which point asking prices scale downward, but the small amount of business actually done has been at lower figures than these nominal asking prices. To inquiries for domestic delivery slightly higher prices are named than are accepted for export, but if there were any important orders in the market they would doubtless be eagerly competed for. The copper recently offered by second hands appears to have been absorbed. The market closes steady at 13⅜ @13⅝c. for Lake and 13¼@13⅜ for electrolytic. Casting has averaged 13@13⅛c. during the week.

The standard market in London does not show much change either way in its fluctuations throughout the week. The close is slightly better at £59 17s. 6d. for spot, £60 13s. 9d. for three months.

Refined and manufactured sorts we quote: English tough, £63 10s.; best selected, £62 10s.@63 10s.; strong sheets, £74 10s.@75 10s.

Exports of copper from New York and Philadelphia for the week were 4960 long tons. Exports from Baltimore, as reported by our special correspondent, were 342 tons.

Manufactured Copper—Sheets, cold-rolled, 19c. per lb.; hot-rolled, 18c. Copper wire, 15¼c. base, carload lots at mill.

Tin—The London market showed some signs of manipulation in a downward direction incident to the Banka sale which took place during the week. After the consummation of this sale, prices hardened and the close is very firm at £134 for spot, £135 10s. for three months.

A fairly good-sized business was done among New York dealers, while orders on the part of consumers were placed for their immediate requirements only. As supplies of raw materials are quite large, the premium which existed some time ago has entirely disappeared, and quotations at the close are made at around 29½ cents.

Lead—The offers from St. Louis on the one hand and on the part of local speculators on the other have been of liberal volume and most insistent, so that prices have given way further, the close being weak at 4.42½@4.47½c. New York.

The St. Louis market is reported dull and lower. Sales have been made on a basis of 4.32½c. for Missouri brands.

The London market is somewhat firmer, closing at £13 5s. for Spanish lead, £13 7s. 6d. for English lead.

Spelter—There is no change. A sprinkling of orders is being placed right along, as the rank and file of consumers are entirely bare of supplies. The close is steady at 4.60@4.65 St. Louis, 4.75@4.80 New York.

The market abroad is again somewhat higher and closes firm at £19 15s. for good ordinaries, £20 for specials.

Zinc Sheets—Base price is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—The market is quiet and little business is being done. There were a number of sales the latter half of last week, but the activity was short lived. Quotations are 8¼@8½c. for Cookson's, 7⅞@8⅛c. for Hallett's, and 7½@7¾c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base.

Cadmium—In 100-lb. lots, $1.25 per lb., at Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 40@50c., New York.

Quicksilver—New York price is $42.50 per flask for large lots; small orders depend on size and conditions. San Francisco nominal, about $42 for domestic orders, and $40 for export. London price is higher, at £8 5s. per flask, but £8 is done with jobbers.

Platinum—Quotations are $22.50 for hard platinum, $20 for ordinary, and $16 for scrap.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, eight months ended Aug. 31, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.	
Copper	113,896	42,352	Imp.	71,544
Copper, 1907	75,131	46,699	Imp.	28,432
Tin	30,070	27,240	Imp.	2,830
Tin, 1907	29,617	25,350	Imp.	4,067
Lead	156,206	35,288	Imp.	120,918
Lead, 1907	131,503	31,127	Imp.	100,376
Spelter	70,483	5,228	Imp.	65,255
Spelter, 1907	72,220	3,743	Imp.	68,477
Quicksilver, lb.	3,069,698	1,087,946	Imp.	1,981,752
Quicksilver, '07	2,901,596	1,595,975	Imp.	1,305,621

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Tin-ore imports, 15,223 tons in 1907, and 17,722 in 1908; increase, 2499 tons. Iron and copper pyrites, 521,219 tons in 1907, and 547,946 in 1908; increase, 26,727 tons. Of the imports this year the United States furnished 4794 tons copper matte, 44,697 tons fine copper and 25,210 tons lead.

Missouri Ore Market

Joplin, Mo., Sept. 26—The highest price paid for zinc ore was $41 per ton, on a base price of $38. Some ore sold as low as $37 per ton of 60 per cent. zinc. The base price of silicate of zinc was $20, some ore selling as high as $26.50. The average price, all grades, was $34.78 per ton. One bin of lead sold at $56, but the general price was $54 until Thursday, when it dropped to $53, closing the week at the lower figure. The average price, all grades, was $53.84 per ton.

The output is surprising, after a trip over the district which discloses a number of big mills around Webb City, Carterville and Duenweg still closed down. Many mines, however, have been developed from prospects of a year ago. In the Webb City field richer sheet-ore mines have been opened, and a number of new "free-ore" mines have been developed around Joplin, while new mines have been opened at Quapaw-Baxter and Miami, in Oklahoma.

Following are shipments for the week ended Sept. 26:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,237,330	629,610	$76,240
Joplin	2,534,720	262,270	50,805
Galena	691,610	138,990	16,201
Oronogo	591,550	59,800	12,473
Spurgeon	445,840	86,380	10,087
Badger	413,480	.....	7,856
Alba-Neck	412,610	.....	7,426
Miami	429,290	65,060	7,336
Quapaw-Baxter	401,860	3,800	6,925
Granby	503,000	22,300	6,850
Aurora	384,980	17,840	6,262
Duenweg	270,240	50,620	6,229
Carthage	276,310	.....	5,249
Prosperity	155,390	74,450	4,806
Sarcoxie	122,710	.....	2,208
Cave Springs	87,840	.....	1,581
Carl Junction	61,010	4,270	1,274
Zincite	27,370	.....	479
Totals	11,046,600	1,415,390	$230,287
Nine months	372,007,720	56,786,380	$7,846,932

Zinc value, the week, $192,176; 9 months, $6,274,672
Lead value, the week, 38,111; 9 months, 1,572,260

Average prices of ores in the Joplin market by months have been, per short ton, as follows:

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	$46.90	$37.60	$45.84	$35.56	$83.58	$46.88
February	48.30	36.63	47.11	34.92	84.58	49.72
March	49.75	36.19	48.66	34.19	82.75	49.90
April	49.25	35.40	48.24	34.08	79.76	52.47
May	46.90	34.19	45.98	33.39	79.56	56.05
June	47.00	33.06	44.82	32.07	73.66	60.48
July	46.80	34.55	45.79	31.67	58.18	59.90
August	44.56	36.53	43.22	33.42	59.54	60.34
September	41.00	37.13	40.11	34.44	53.52	54.59
October	41.75	.....	39.83	.....	51.40	.....
November	38.60	.....	35.19	.....	43.40	.....
December	31.50	.....	30.87	.....	37.71	.....
Year	$44.36	.....	$43.68	.....	$68.90	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Sept. 30—The general market is beginning to show a slight improvement; dealers report more business although the volume is still below normal for this time of year.

Arsenic—White arsenic is freely offered at 3¼@3⅜c., which is as low as at any time this year. Consumption is small and mostly for immediate delivery.

Copper Sulphate—The demand has slackened and the volume of business is less than for the last two or three weeks. Standard goods are still quoted at $4.65 per 100 lb. in carloads and up to $4.90 in smaller lots.

Nitrate of Soda—The market is quiet and buyers are exceedingly cautious. Prices are 2.25c. for the rest of 1908 and for 1909, but it is reported that spot quotations are being made at a lower figure than those given out by the principal dealers.

Mining Stocks

New York, Sept. 30—The excitement and recession in the general stock markets, which were reported last week, have given way to a rather dull and uncertain market. The volume of trading dropped abruptly and prices have been irregular. Political and other conditions have not changed, and matters have depended very much on the ideas of individual operators. The public seems to have taken little active interest.

On the Curb, trading followed the lead of the Exchange, and was not especially active. There was some selling of copper stocks, but the leaders in the trading were found among the shares which are not usually very active. The only sensation was a sharp break in Standard Oil, on light trading.

Boston

Sept. 29—The mining-share market has diminished quite a bit in the volume of business, but prices have stiffened materially, considering the little public interest taken. Some specialties have been active, and sharp advances were recorded in a few cases, although moderate reactions followed. The declaration of the regular quarterly dividend of 50c. by Anaconda mining directors gives a little inspiration and a forecast that there is little or no likelihood of any increase in the Amalgamated Copper Company's rate.

North Butte has been in active demand, and is readily absorbed on reactions for Western account. From $77.50 it rose smartly to $82.75, reacted to $78.62½, and closed tonight at $80. Atlantic spurted $2.50 to $18.50, losing $1.25 of it. The advance was due to report of important developments on the section 16, 13th level toward the Baltic mine. Isle Royale, in sympathy, rose $4.25 to $24.25, reacting to $22 again.

Amalgamated rose $4.75 to $75, but closed at $73.25 tonight. Copper Range spurted $3.75 to $74, closing at $73 tonight. P. W. Denton, of Painesdale, Mich., has been elected a director of this company to succeed Cameron Currie, of Detroit.

The Curb has also shown gradual stiffening in prices. Keweenaw has been soft, falling from $4.25 to $3 on the announcement of a $2 assessment, payable in two instalments of $1 each. Superior & Boston rose sharply from $7.25 to $9.37½, and East Butte $1.12½ to $8.12½.

STOCK QUOTATIONS

NEW YORK Sept. 29	
Name of Comp.	Clg.
Alaska Mine	⅜
Amalgamated	73⅛
Anaconda	43½
Balaklala	‡4⅛
British Col. Cop.	6½
Butte & London	....
Butte Coalition	24½
Colonial Silver	⅝
Cum. Ely Mining	7⅛
Davis Daly	1 1/16
Dominion Cop	1
Douglas Copper	3½
El Rayo	3⅜
Florence	3½
Foster Cobalt	.62
Furnace Creek	.16
Giroux	4⅜
Gold Hill	⅜
Goldfield Con.	5 1/16
Granby	‡97
Greene Gold	¾
Greene G. & S	½
Greenw'r & D.Val.	‡ 75
Guanajuato	2½
Guggen. Exp.	160
Hanapah	‡ 20
McKinley Dar.	1.00
Mcmac	2½
Mines Co. of Am.	1⅞
Mitchell Mining	⅛
Mont. Sho.C	⅞
Nev. Utah M. & S.	3
Newhouse M. & S.	5½
Nipissing Mines	8⅝
Old Hundred	½
Silver Queen	1.25
Stewart	1/16
Tennessee Cop'r.	29⅛
Tri-Bullion	1
Union Copper	⅝
Utah Apex	4⅛
Utah Copper	41
Yukon Gold	4 1/16

BOSTON Sept. 29	
Name of Comp.	Clg.
Adventure	8¼
Algomez	34
Am. Zinc	21¾
Arcadian	2½
Arizona Com	28½
Atlantic	17⅝
Bingham	‡ 40
Boston Con	13¾
Calumet & Ariz.	114½
Calumet & Hecla	640
Centennial	32
Con. Mercur	‡.40
Copper Range	72½
Daly West	9
Franklin	12
Greene Can	10¼
Isle Royal	22⅝
La Salle	18¼
Mass	6½
Michigan	12¾
Mohawk	60½
Nevada	15½
North Butte	79½
Old Colony	.60
Old Dominion	40
Osceola	106
Parrot	‡.26
Quincy	90
Rhode Island	4½
Santa Fe	‡1⅜
Shannon	14¾
Superior	24
Tamarack	70
Trinity	18½
United Cop., com.	10⅝
U. S. Oil	‡24¾
U. S. Smg. & Ref.	39⅞
U.S.Sm. & Re.,pd.	45
Utah Con	43
Victoria	4¼
Winona	25½
Wolverine	‡140
Wyandotte	12⅝

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	28
Am. Smelt. & Ref	83¾
Am. Sm. & Ref., pf.	‡102½
Bethlehem Steel	‡22
Colo. Fuel & Iron	34½
Federal M. & S.,pf.	‡85
Inter. Salt	18½
National Lead	82½
National Lead, pf.	‡102
Pittsburg Coal	‡10⅝
Republic I. & S.	‡21½
Republic I. & S.,pf.	77⅜
Sloss-Sheffield	60
Standard Oil	615
U. S. Red. & Ref.	29
U. S. Steel	44⅞
U. S. Steel, pf	108½
Va. Car. Chem	29½

BOSTON CURB	
Ahmeek	100
Black Mt.	3½
East Butte	8
Hancock Con.	5¾
Keweenaw	3½
Majestic	.71
Raven	.85
Shawmut	.20
Superior & Pitts.	13½
Troy Man.	‡ 30

ST. LOUIS Sept. 26		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	05	.03
Center Cr'k	2 25	1.50
Cent. C. & C.	68 00	67 00
C.C. & C. pd.	74 00	72 00
Cent. Oil	110 00	100 00
Columbia	5 00	3 00
Con. Coal	21 00	19 00
Doe Run	126 00	110 00
Gra. Bimet.	.20	16
St. Joe	14 00	12 50

LONDON Sept. 30	
Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd	0 1 0
Camp Bird	0 13 3
Esperanza	3 8 9
Tomboy	1 2 6
El Oro	1 6 3
Oroville	0 11 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Sept. 30.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.16
Belcher	.24	St. Ives	.25
Best & Belcher	.41	Triangle	.04
Caledonia	.12	BULLFROG STOCKS	
Challar	18	Bullfrog Mining	.03
Comstock	‡ 24	Bullfrog Nat. B.	.08
Con. Cal. & Va.	.71	Gibraltar	.03
Crown Point	.27	Gold Bar	.03
Exchequer	.25	Homestake King.	.26
Gould & Curry	.08	Montgomery Mt.	.07
Hale & Norcross	.30	Mont. Shoshone C.	.81½
Mexican	.74	Original Bullfrog	.01
Ophir	1.75	Tramp Cons.	.16
Overman	.15	MANHAT'N STOCKS	
Potosi	.17	Manhattan Cons	.06
Savage	.28	Manhat'n Dexter	.05
Sierra Nevada	.20	Jumping Jack	.03
Union	.29	Stray Dog	.03
Utah	.05	MISCELLANEOUS	
Yellow Jacket	.50	Golden Boulder	.06
TONOPAH STOCKS		Bonnie Clare	.06
Belmont	1 27	Lee Gold Grotto	....
Extension	.64	Nevada Hills	1.10
Golden Anchor	.02	Nevada Smelting	.87½
Jim Butler	.25	Pittsburgh S. Pk	.96
MacNamara	.50	Round Mt. Sphinx	.15
Midway	.29		
Montana	.95		
North Star	.06		
Tono'h Mine of N.	7 12½		
West End Con	.50		
GOLDFI'D STOCKS			
Adams	.04		
Atlanta	.23		
Booth	.46		
Columbia Mt	.22		
Comb. Frac	1 39		
Cracker Jack	.06		
Dia'dfield B. B. C.	.15		
Goldfield Belmont	.15		
Goldfield Daisy	.82		
Great Bend	.34		
Jumbo Extension	.36		
Katherine	...		
Kendall	.14		
Lone Star	.08		
May Queen	.06		
Oro	.11		
Red Hill	.22		
Roanoke	...		
Sandstorm	.22		

COLO. SPRINGS Sept. 26	
Name of Comp.	Clg.
Acacia	‡6½
Black Bell	....
C. C. Con	3¾
Dante	....
Doctor Jack Pot	6½
Elkton	65
El Paso	37
Findlay	21
Gold Dollar	7
Gold Sovereign	3
Isabella	26½
Index	....
Jennie Sample	2½
Jerry Johnson	34
Mary McKinney	31
Pharmacist	‡3½
Portland	1 05
Un. Gold Mines	4
Vindicator	83½
Work	7

Assessments

Company.	Delinq.	Sale.	Amt.
Belcher, Nev.	Sept. 15	Oct. 6	$0.10
Bullion, Nev.	Oct. 29	Nov. 20	0.05
Caledonia, Nev.	Oct. 21	Nov. 11	0.05
Challenge Con., Nev.	Aug. 31	Sept. 22	0.05
Con. Imperial, Nev.	Sept. 29	Oct. 22	0.01
Gould & Curry, Nev.	Oct. 7	Oct. 29	0.10
Lady Washington, Nev.	Oct. 26	Nov. 16	0.05
Nevada Fairview	Sept. 14	Oct. 26	0.005
Nonpareil, Utah	Sept. 15	Oct. 15	0.01
Overman, Nev.	Sept. 23	Oct. 14	0.05
Potosi, Nev.	Sept. 4	Sept. 29	0.10
Savage, Nev.	Aug. 27	Sept. 18	0.10
Sierra Nevada, Nev.	Oct. 14	Nov. 4	0.10
Signet	Aug. 8	Oct. 6	0.01
Union Con., Nev.	Sept. 15	Oct. 7	0.10
Wabash, Utah	Sept. 15	Oct. 8	0.07
West Quincy, Utah	Sept. 12	Oct. 1	0.08
Wheeler, Utah	Oct. 5	Oct. 23	0.01
Yellow Jacket, Nev.	Aug. 10	Sept. 15	0.25

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68 673	55 678	31 769	25.738
February	68 835	56.000	31 852	25.856
March	67 519	55 365	31 325	25.570
April	65 462	54 505	30 258	25.133
May	65 971	52 795	30 471	24.377
June	67 090	53 663	30 893	24 760
July	68 144	53.115	31 366	24.514
August	68 745	51 684	31 687	23.856
September	67 792	51.720	31 313	23.877
October	62 436	.....	28 863	.....
November	58 677	.....	27 154	.....
December	54 565	.....	25 362	.....
Year	65 327	....	30.188	....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24 404	13 726	24 825	13 901	106 739	62 386
February	24 869	12 905	25 246	13 098	107 356	58 786
March	25 065	12 704	25 540	12 875	106 594	58 761
April	24 224	12 743	25 260	12 928	98 625	58 331
May	24 048	12 598	25 072	12.788	102 375	57 397
June	22 665	12 675	24 140	12 877	97 272	57 842
July	22 130	12.702	23 923	12.933	95 016	57 969
August	18 356	13.462	19 255	13 639	79 679	60.500
September	15 565	13.388	16 047	13.600	68 375	60.838
October	13 169	.....	13 551	.....	60 717	.....
November	13.391	.....	13.870	.....	61 226	.....
December	13 163	.....	13 393	.....	60 113	.....
Year	20 004	.....	20 661	.....	87 007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41 548	27 380	July	41 091	29 207
February	42 102	28 978	August	37 667	29.942
March	41 334	30 577	September	36 689	28.858
April	40 938	31 702	October	32 620	.....
May	43 149	30 015	November	30 893	.....
June	42.120	28 024	December	27 925	.....
			Av. year.	38.166	.....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6 000	3 691	19 828	14 469
February	6 000	3 725	19 531	14 250
March	6 000	3 838	19 703	13 975
April	6 000	3 993	19 975	13 469
May	6 000	4.253	19 688	12 938
June	5 760	4 466	20 188	12 600
July	5 288	4.447	20 350	13 000
August	5 250	4.580	19 063	13.375
September	4 813	4.515	19 778	13.125
October	4 750	.....	18 531	.....
November	4.376	.....	17.281	.....
December	3 658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6 732	4 513	6 582	4.363	27 125	20 563
February	6 814	4 788	6 664	4.638	25 938	20 875
March	6 837	4 665	6 687	4.527	26 094	21 075
April	6 685	4 645	6 535	4.495	25 900	21 344
May	6 441	4.608	6 291	4.458	25 563	19.966
June	6 419	4 543	6 269	4 393	25 469	19 000
July	6 072	4.485	5 922	4.338	23 850	19.031
August	5 701	4 702	5 551	4.556	21 969	19.350
September	5 236	4.749	5 086	4.619	21 050	19.563
October	5 430	.....	5 280	.....	21 781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4 254	.....	4 104	.....	20 075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Bort, good drill quality, carat		$85.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¼@.06
Emery, in kegs; Turkish flour	"	.01⅞@.02½
Grains	"	.03½@.04½
Naxos flour	"	.01⅞@.02½
Grains	"	.03½@.04½
Chester flour	"	.01½
Grains	"	.03½@.04½
Peekskill, f.o.b. New York, flour	"	.01½@.01½
Grains, in kegs	"	.02½@.02½
Garnet, per quality	sh. ton	25.00@35.00
Pumice Stone, Am. powd., 100 lb.		1.60@2.00
Italian, powdered	"	.01½@.01½
Lump, per quality	"	.03@.20
Rottenstone, ground	"	.02@.04
Lump, per quality	"	.05@.25
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07½@.07¾
ACIDS—		
Acetic 28%	lb.	.026@.03
Boric	"	.08@.08½
Hydrofluoric, 30%	"	.02½@.03
" 48%	"	.06
" 60%	"	.10
Hydrochloric acid, 20°, per lb.		1.25@1.50
Nitric acid, 38°	per lb.	4.25@4.62½c.
Sulphuric acid, 50°, bulk per ton.		$12 up
60°, 100 lb. in carboys.		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys.		1.00@1.25
66°, bulk, ton		18.00
Oxalic	"	.06½@.06¾
ALCOHOL—Grain 95%	gal.	2.63
Denatured	"	.43@.49
Refined wood, 95@97%	"	.47@.53
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	lb.	.04½@.05
ALUMINUM—Sulphate, com'l.	lb.	1.10@1.75
AMMONIA—24 deg. lb	"	.04½@.05½
" 26 deg. lb		.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.23
Carbonate	"	.07⅞@.08
Muriate grain	"	.05¾@.06⅛
Lump	"	.09½@.09½
Sulphate, 100 lb		3.05@3.10
Sulphocyanide com	"	.30
" chem. pure	"	.40
ANTIMONY—needle, lump	"	.03½@.03½
ARSENIC—White	"	.03½@.03⅝
Red	"	.07½@.07¾
ASPHALTUM—		
Barbadoes	per ton.	40.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.10@.11
Gilsonite, Utah, ordinary	per ton.	32.00
Trinidad	"	22.50@30.00
California	"	21.00@27.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton.	30.00@35.00
Precipitated 96@98%		36.00@40.00
Powdered, 80@90%	lb.	.02@.02½
Chloride com'l	ton.	39.00@41.00
Nitrate powdered, in casks	lb.	.05½@.06
Blanc Fixe	per lb.	.02¼
BARYTES—		
Am. Ground	sh. ton.	14.00@21.00
Floated	"	22.00
Foreign floated	"	19.50@22.50
BISMUTH—Sub-nitrate	lb.	1.50
BLEACHING POWDER—35%, 100 lb.		1.25@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb.		4.65
BONE ASH	lb.	.02¾@.04
BORAX	"	.04½@.05½
CALCIUM—Acetate, gray, 100 lb.		2.00@2.05
Acetate, brown	lb.	1.25@1.30
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J	sh. ton.	65.00
Chloride, f.o.b. N. Y	"	11.00@14.00
CEMENT—		
Portland, Am. 500 lb	bbl.	1.55@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb	"	.85
(in sacks)	"	.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y	per lg. ton.	17.50@20.00
Bricks, f.o.b. Pittsburg, M	ton.	175.00
CLAY, CHINA—Am. common ex-dock, N. Y	ton.	8.00@9.00
Foreign	"	10.00@17.50
COBALT—Oxide	lb.	1.45
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.75
In bags	"	.60@.70
CRYOLITE	lb.	.06½@.06¾
FELDSPAR—Ground best	sh.ton.	10.50@15.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis No. 1	"	18.00
" No. 2	"	15.00
Extra	"	20.00@23.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8.00@10.00
Ground	"	11.50@13.50
Foreign crude ex. dock		8.00@10.00
FULLER'S EARTH—Lump, 100	lb.	.75@.85
Powdered	"	.75@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.01@.04
Dust	"	.01¾@.05
Chip	"	.02¾@.07½
Lump	"	.04@.10
Large lump	"	.07@.10
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. Best	lb.	.01¾
French	lg. ton	56.00
German	lb.	.02¼@.02⅝
LEAD—Acetate (sugar of) brown,	lb.	.07¾
Nitrate, com'l	"	.08¼@.08¾
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	8.00@10.00
Calcined, powdered	sh. ton.	26.00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	.85@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@.01½
75@85% binoxide	"	.01¼@.01½
85@90% binoxide	"	.01½@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	16.00@32.50
MARBLE—Flour	sh. ton.	8.50@10.00
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
Selected	"	40.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, nominal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.09@.11
Sulphate, double	"	.06½@.08
NITRATE OF SODA—100 lb. 95% for '08		2.25
95% for 1909		2.25
95% for 1910		2.22½
96% is 5c. higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.06½@.06¾
English glassmakers'	"	.08¼@.08½
Lithopone	"	.03¾@.07
Metallic, brown	sh. ton.	16.50@22.00
Red	"	14.00@18.00
Ocher, Am. common	"	8.50@9.00
Best	"	16.00
Dutch, washed	lb.	.02½@.03
French, washed	"	.01½@.02½
Paris green, pure, bulk	"	.26
Red lead, American	"	.06½@.06¾
Foreign	"	.08¼@.08½
Turpentine, spirits bbl., per gal.		.42½
White lead, Am., dry	lb.	.05¾@.06
American, in oil	"	.06¼@.06¾
Foreign, in oil	"	.10¼@.10⅜
Zinc white, Am. extra dry	"	.05¼@.05⅝
French, red seal, dry	"	.08¼@.08¾
French, Green seal, dry	"	.10½@.10¾
PHOSPHATES—Acid		60c. per unit
*Fla., hard rock		10.00@10.25
land pebble 68%		4.25@4.50
†Tenn., 78@80%		6.00@6.50
75%		5.00@5.50
68@72%		4.00@4.50
‡So. Car. land rock		6.75@7.00
" " river rock		5.00@5.50
POTASSIUM—		
Bicarbonate crystal	lb.	$.08½@.09
Powdered or granulated	"	.09@.09½
Bichromate, Am.	"	.08½@.09
Scotch	"	.10½
Bromide	"	.14@.16
Carbonate (80@85%)	"	.03¾@.04
Caustic, ordinary	"	.04½@.05¾
Elect. (90%)	"	.05½@.06
Chloride (muriate), 100 lb		1.90
Chlorate, powdered	"	.09½@.09¾
Crystals	"	.09@.09½
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons	"	19c.
Kainite, long ton, bulk, 8.50; bags, 9.50.		
Permanganate	lb.	.09½@.10
Prussiate, yellow	"	.13½@.14
Red	"	.32@.36
Sulphate	100 lb.	2.18¼@2.21½
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported non-arsenical, furnace size, per unit		.12½@.13
Imported, arsenical, furnace size, per unit		.12@.12½
Imported fines, arsenical, per unit.		.08½@.09
Imported fines, non-arsenical, per unit		10½@11c.

Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb. bbl.		.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.50@5.00
Refined, crystals	"	5.50@6.00
SILICA—		
Ground quartz, ord'ry	lg. ton.	10.00@15.00
Silex, ground	"	13.00@15.00
Silex, floated	"	35.00@40.00
Lump quartz	"	5.00@6.00
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.37½@.4
SODIUM—		
Acetate	lb.	.04½@.04½
"Alkali," per 100 lb., 58/48		.80@.87½
Bicarb. soda, per 100 lb		1.00@1.30c.
Soda, caustic, per 100 lb., 76/60		1.75@1.85
Soda, caustic, powdered		.02¾@.03¼
Salt cake, per 100 lb., bulk		.40
Salt cake, bbl		.65@.85
Soda, monohydrate, per lb		1.4@1.75c.
Bichromate	lb.	07½@.07¾
Bromide	"	.14@.16
Chlorate, com'l	"	09@.09½
Cyanide ("100% KCN")		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Hyposulphite, Am.	"	1.35 up
German	"	1.60@1.70
Phosphate	100 lb.	2.10@2.30
Prussiate	"	08½@.09
Sal soda, f.o.b. N. Y.	100 lb.	.65@.70
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	80@1.15
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.75
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	07½@.8½
SULPHUR—		
Louisiana (prime) to New York, Boston or Portland	lg. ton.	22.00
To Philadelphia or Baltimore	"	22.00
Roll	100 lb	1.85@2.15
Flour	"	2.00@2.40
Flowers, sublimed	"	2.20@2.60
TERRA ALBA—French & Eng.	100 lb.	.85@1.00
TALC—Domestic	sh. ton.	15.00@25.00
French	"	16.00@25.00
Italian, best	"	35.00@40.00
TIN—Bi-chloride, 50%	lb.	09 up
Crystals	"	.18½ up
Oxide, lb	"	.33@.35
URANIUM—Oxide	"	3.50
ZINC—		
Chloride solution, com'l 20°	"	.02½
Chloride, granular	"	.04½@.05
Dust	"	.04½@.05
Sulphate	"	.02@.02½

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites, and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

THE MINING INDEX

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7381—ALUMINUM CARBIDE—Formation and Preparation of Aluminum Carbide. M. Camille Matignon. (Journ. Frank. Inst., Sept., 1908; 10 pp.) Discusses the theory of the formation of aluminum carbide and describes the methods of preparing it in several different ways. 60c.

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7528—ORE DEPOSITION—Organic Matter in Mines, Veins, and Ore Deposits. Arthur Lakes. (Min. Sci., Aug. 27, 1908; 1 p.) Discusses the occurrence of graphitic gangue, fossil leaves and fragments of wood in certain districts which has either been replaced by or recovered by metals. 20c.

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7546—MINE BELL SIGNALS—A Comprehensive Review. G. T. Plumb. (So. African Min. Journ., Aug. 15, 1908; 1¼ pp.) Discusses in a general way the requirements of installations of bell signals in mines and points out some of the faults that are liable to exist. 20c.

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7556—ORE HANDLING DOCK—The New Ore and Coal Handling Dock of the Pennsylvania Company, at Ashtabula Harbor, Ohio. (Eng. Rec., Sept. 12, 1908; 4¾ pp.) Describes the building and construction of the large dock and ore handling methods at this port which handles the largest tonnage of any port on Lake Erie. Illustrated. 20c.

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ORE DRESSING—GENERAL

7564—CONCENTRATION— Methods of Concentration at Cobalt, Ontario. (Can. Min. Journ., Sept. 15, 1908; 2½ pp.) Describes the operation of the mills belonging to the Buffalo, Cobalt Central, and Coniagas mines and also the Muggley concentrator which is a custom mill. 20c.

7565—GRINDING. Oskar Nagel. (Electrochem. and Met. Ind., Sept., 1908; 3½ pp.) Discusses grinding of raw materials and finished products by means of gyratory crushers, crushing rolls, jaw crushers, stamp mills, ball mills, cominuters, impact pulverizers, etc. Illustrated. 40c.

7566—ORE SORTING at the Cabrestante Mines, Santa Barbara, Mexico. Claude T. Rice. (Eng. and Min. Journ., Sept. 5, 1908; 2¼ pp.) Describes the method of sorting ore by contract. The Mexican peon is very efficient at sorting ore by hand. Illustrated. 20c.

7567—SAMPLER—An Automatic Ore Sampler. S. E. Bretherton. (Min. and Sci. Press, Sept. 5, 1908; 1½ pp.) Describes a simple machine for automatically taking the first sample and then completing the sample by hand labor. Illustrated. 20c.

7568—SAMPLING by Machines. John A. Church. (Eng. and Min. Journ., Aug. 29, 1908; 2 pp.) Discussion by the author relative to some of the criticisms of his article in which he refers to Mathewson's table of mill tests. 20c.

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